January 1, 1945

STEEL

The Magazine of Metalworking and Metalproducing

IN TWO SECTIONS ESTABLISHED 1882 SECTION ONE

PUBLIC LIBRARY
DETROIT

From steel to finished product—
everything that science can
contribute to bearing perfection

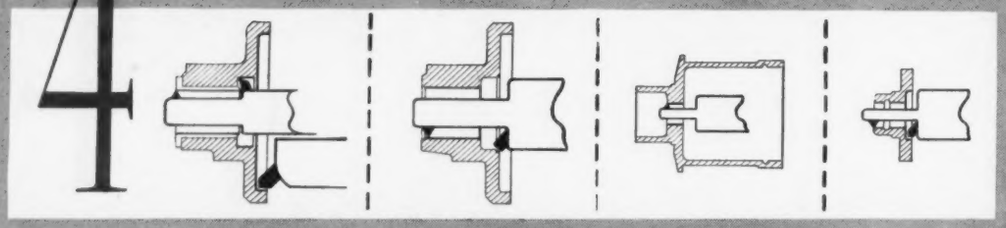
nothing rolls like a ball

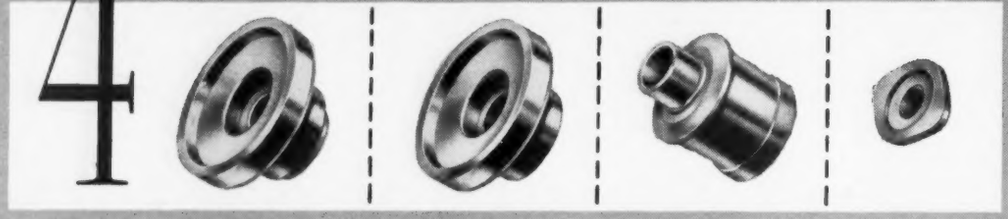
NEW DEPARTURE
BALL BEARINGS

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONNECTICUT

R v.116' Ja-F 1945

4 OPERATIONS ON 4 PARTS SIMULTANEOUSLY!





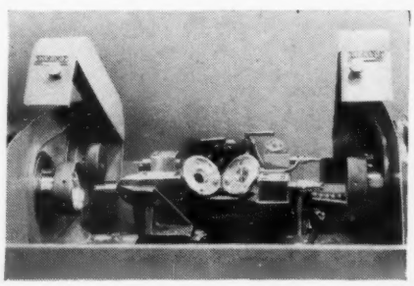
A Single HEALD BORE-MATIC *Does It!*

What can *borizing* on Bore-Matics do for you? In short, it will enable you to hold closer tolerances, obtain a better finish and step up production rates. And these results can be obtained on *all* types of operations — on *all* types of work.

The basic adaptability of Heald Bore-Matic design makes it possible, for example, to do boring, turning, facing, chamfering, grooving and fly-cutting. Straight and taper surfaces can be machined as well as curves and irregular shapes. All these operations can be performed singly, simultaneously, progressively, or in combination. In addition to final finishing — where the surface obtained often reduces or even eliminates lapping and honing — Bore-Matics are applicable for roughing and semi-finishing.

To help in planning faster, lower-cost production, better post-war products ... get the Bore-Matic story *today*.

THE HEALD MACHINE CO.
WORCESTER 6, MASS.



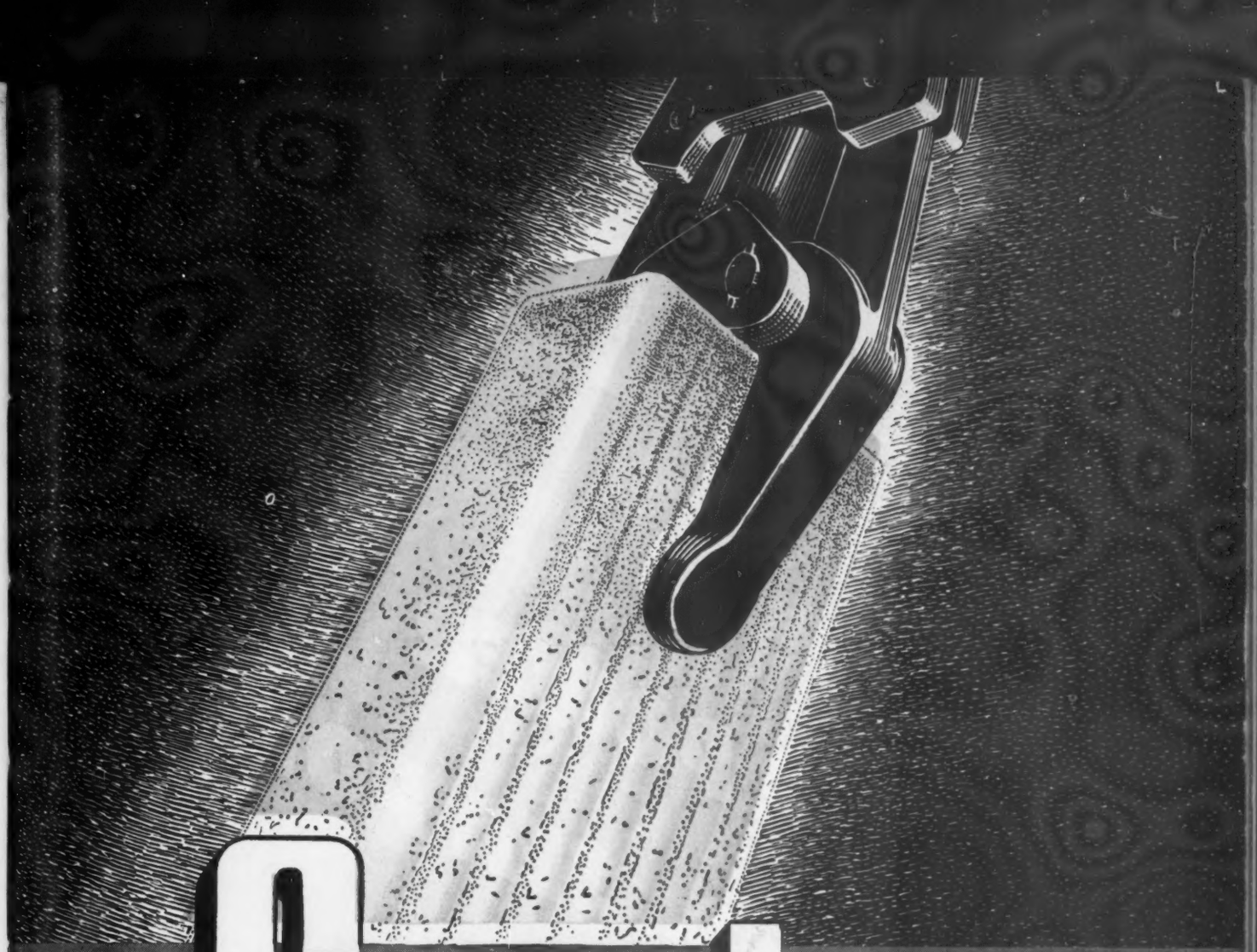
This Heald Bore-Matic is arranged to precision finish four different parts in the same cycle. Adapter Assembly, Housing, Adapter and Coupling are held in rotating fixtures and several finishing operations performed on each piece—including facing, boring, counterboring and chamfering.

HEALD *Bore-Matics*

THE MOST VERSATILE MACHINE TOOL

Internal and Surface Grinding Machines • Bore-Matic Precision Finishing Machines

Tech



Steel

to speed
the winning of the war
and to promote
the arts of peace
in the years that follow.

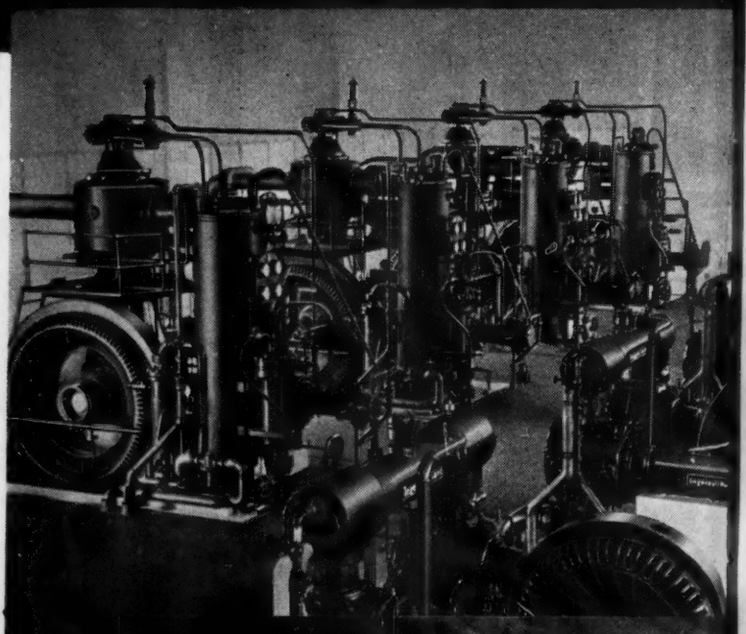
BETHLEHEM STEEL

AIR POWER for SEA POWER

Inside a modern torpedo, compressed air supplies the oxygen needed to burn alcohol in a tiny boiler which generates the steam for running the torpedo's turbine and propellers. It also operates the gyroscope, and controls the torpedo.

In order to store a lot of air within a small space, this air is compressed to about 3000 pounds per sq inch pressure. For charging torpedoes on board Navy fighting ships and at Army and Navy airfields, Ingersoll-Rand has built hundreds of high-pressure heavy-duty compressors of small, compact design. Some of these are small enough to fit into the baggage compartment of your car.

Compressed-air power is also essential to the manufacture and testing of torpedoes. Shown here is a battery of Ingersoll-Rand air compressors consisting of four 400-horsepower, 4-stage units supplying 4000-pound air for testing, and four 2-stage machines furnishing 100-pound air power needed in the manufacturing process. Identical installations of these compressors are in two other torpedo plants.



Ingersoll-Rand has built air and gas compressors for pressures from vacuum to 15,000-pound per sq inch for all kinds of services. Call upon this experience when you need compressors.

1-458

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • OIL AND GAS ENGINES

In war or peace
B.F.Goodrich
FIRST IN RUBBER

1900-foot rubber band snaps iron through a mountain

A typical example of B. F. Goodrich development in rubber

WAR DEMAND for iron ore last year was so great that companies searched out even the "worked over" mines. The one in the picture had some ore — but at the bottom of a pit.

The way to get it out was by conveyor belt, but that would be the highest single lift of any belt in the world and conventional belts that were strong enough would be too stiff to trough and carry heavy ore up the mountain side. So three belts were used, each for a third the distance, but even they wore out fast and transfer points required much attention.

An engineer at this mine had heard of B. F. Goodrich cord conveyor belt. Made of parallel cords in rubber instead of woven fabric, it is many times as strong and still as flexible as any former belt. Extraordinary records made by this new B. F. Goodrich belt on other "impossible" jobs convinced the engineer it would stand the strain on this one.

The belt was installed, at a 35% grade — almost a rubber elevator. The shaft went through the mountain itself, from pit to railroad cars on the surface — a 1000-foot run.

The B. F. Goodrich cord belt "troughed" perfectly, eliminated two transfer points and reduced maintenance cost. It has already hauled 800,000 tons of vital iron ore, and the owners say it is good for at least 1,250,000 tons the first year and thousands more the next. Jobs like this, that have looked impossible, are being done every day by B. F. Goodrich industrial rubber products—the developments of constant research. That's why it pays to find out what improvements B. F. Goodrich has made in any rubber product you use. *The B. F. Goodrich Company, Industrial Products Division, Akron, Ohio.*

B.F. Goodrich
RUBBER *and* SYNTHETIC *products*

BEHIND THE SCENES

Special Bargain

■ This is the first of fifty-three weekly issues of STEEL for 1945. That may sound like we're still nursing a good old-fashioned New Year's hangover but it's a fact. Every umpteen years the guy who runs the calendar department throws 53 Mondays into 52 weeks and STEEL has never missed a Monday since 1882, so even though we can't figure it out we play along and you get a special bargain.

Another Winner of the War

■ This is a Christmas yarn that had to be held back until the sound of sleigh bells had passed on into the winter night.

The Boss Man was out and the shop foreman (who insisted he was not the Plant Superintendent) apologized as he led us into the strictly functional office where the chair was of the kitchen variety and the desk was—well, it had been a desk. He said the men in the plant had been afraid for the past several weeks that the Boss would take time off to buy the furniture they all felt the place should have in it. Afraid, for the very good reason that they had bought an office full of the kind of stuff they think he should have there. Christmas was still ten days off.

Later we met the fellow. He's one of the "Little Guys" who are helping by doing an outsize job. He's big and he's rangy and he's tired. He's proud, too, in a humble sort of way, of some of the things his boys have been doing. But he's proudest of all of the fact that all of the boys have stayed with him. All but one, that is, and he is loaned to a bigger outfit where he's doing a highly specialized job. Only four of the men knew how to operate machines when they were hired. They learned on this job to do the high precision work it calls for. Altogether, there are now twenty-four men in the plant.

It's a pretty rugged assignment that's called for, too. We saw one man's time card for the current week. He'd worked 97 hours. Most of his days had started before 5 A. M. He'd gone home at 6 P. M. and come back for 2½ hours after supper four nights.

Before the war this was a battery service station, rebuilding generators and also repairing electric motors for some of the big plants in this western Ohio town. Copper wire became hard to get and the owner asked one of the production men in a customer's plant if he didn't have some work he could do on his lathe (he had two).

That was back in '41 when Rommel was having things his own way in the desert. Tanks had to stop before they could shoot with any degree of accuracy. Someone on our side had figured out a gadget using a gyroscope that they hoped would let a tank hit its target while the tank was moving. This big plant had the job of making the first of these controls. Could he make the flywheels for the gyroscope? He could try.

"I made the first hundred on this $358 South Bend. But the way the machine was worn, I couldn't keep the tolerances. It had to be rebuilt. I made this part (patting a part of the lathe) on a machine that cost $20,000; and this one I made on a $40,000 machine in ..... Company's plant. The officials don't know I touched their machine!" In eight days he had rebuilt his lathe and turned out, with his own hands, the first hundred rotors of the device that drove Rommel out of Africa. Since then he has hired his boys and together they have gone on turning out similar parts for this and other instruments as well as many other precision products. He thinks every bomber built in the USA since 1941 has had aboard at least one part made in this shop.

There's a blower bracket made of magnesium used in various secret devices, of which they made 6000 on their first order. At that time the shop was partly just a galvanized iron shed heated by a big coal heater in the middle. (Quite different the cold day we were there.) Tolerances were next to nothing and the wide variations in temperature in different parts of the shop presented plenty of problems. The rough parts, before machining, were kept in small wire baskets near the heater where "he guessed" the temperature was about 70, and carried back and forth frequently for measurement. He was lucky (sez he) that out of the 6000 he had only 156 rejects for all causes.

When we left, the Boss didn't seem so tired. He'd had a chance to talk about the things "his boys" had been doing. Wish we could have been there on Christmas when he saw the new office stuff they had for him!

Helicopter Answers

■ One of the smartest and most sincere approaches we've seen in a long time is the little booklet being distributed by Kellett Aircraft Corp. entitled "Answering Some Helicopter Questions." Kellett is the oldest rotary wing aircraft manufacturing company in the country and is in a position to give a sincere and factual appraisal of the helicopter and the part it will play in future air developments. It's the kind of selling in reverse that might well be done on many another product which enthusiasts have carried too far into the dream world.

Improvement Needed

■ We'd love to hear the comments of some of our combat pilots on this letter received by Consolidated Aircraft Corp.:

I have just finished a wonderful brake to be put on airplanes. This brake I invented can stop a plane that is doing 400 miles an hour in less than 10 feet.

P.S. Now I am working on an invention to stop the pilot from going through the windshield.

Notes on the Calendar

■ As you stand at the beginning of every new year, you're quick to realize that we humans need a series of fresh starts and that an unending calendar would never be satisfactory. And it's amazing, too, how a year is just about long enough. Some of the days may not seem to have twenty-four hours but 365 days are certainly all you want in any one year.

Happy New Year!

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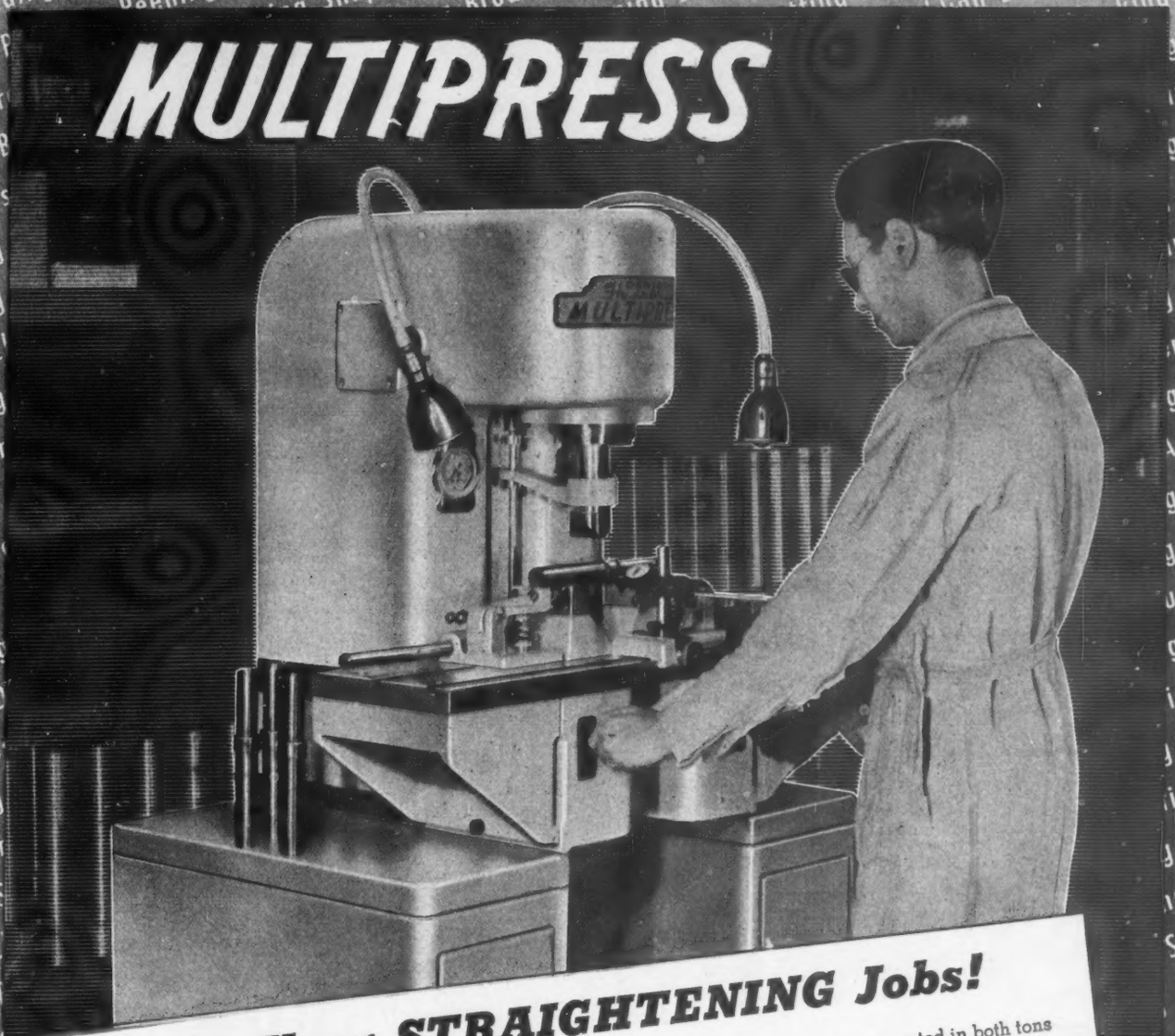
Industry's New Tool of Multiple Uses

MULTIPRESS



—for Your STRAIGHTENING Jobs!

★ Industry's versatile newcomer—MULTIPRESS—equipped with its standard straightening fixtures, can handle any straightening task within its 4-ton pressure range with speed and precision.

Its ram responds instantly to the slightest movement of the control levers . . . may be brought down rapidly or slowly . . . can be stopped anywhere in its downward travel and the work positioned accurately beneath it. Full pressure may be applied at once or increased gradually. Ram pressure limits may be easily and quickly pre-set anywhere between 300 and 8,000 pounds. Ram travel may be limited anywhere between 1/16-inch and 6 inches.

Spring mounted gauging rolls, or gauging centers, disengage the work from the V-blocks for easy checking. The precision gauge on the straightening fixture checks shaft deflection, while the gauge in the throat of MULTIPRESS shows pressures exerted in both tons and pounds per square inch. Straightening tools screw into the internally threaded ram, and are available in radius, inverted radius, and flat styles. Adjustable lights—another MULTIPRESS accessory—afford light, without glare, on the exact work area.

Straightening is just *one* example of the amazingly wide range of production operations to which the basic MULTIPRESS (as shown below) can be quickly adapted. Other accessories include Motor-driven Indexing Tables, Automatic Cycling Action, Vibratory HydrOILic Pressure Ram Action, and others. Only 16 inches wide, 26 inches deep, and 34 inches high, the unit is a completely self-contained, motor-driven, oil-hydraulic machine tool . . . delivered ready to go to work after electrical connections have been made. Write for details!

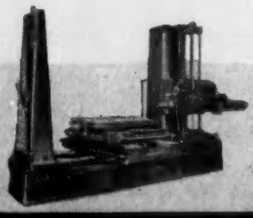
The Denison Engineering Co., 1163 Dublin Rd., Columbus 16, Ohio

DENISON
EQUIPMENT *in* APPLIED
HydrOILics

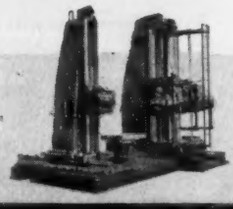
Weldment being machined with headstock in its uppermost position on column. Vertical rotary table indexes work within the range of the cutting tool, doubling vertical machining capacity.

GIDDINGS & LEWIS

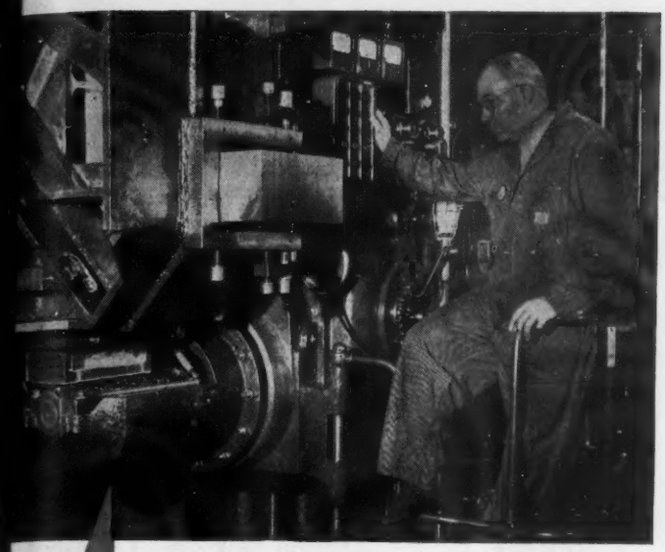
148 DOTY STREET



Right: G. & L. Table Type Machine.



Right: G. & L. Floor Type Machine.



Slab milling ends of weldment. Work and holding fixture are easily indexed on the vertical rotary table into correct machining position.

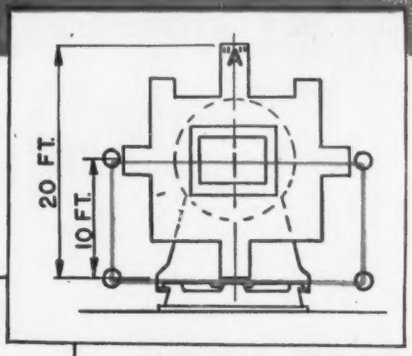
Power Driven Rotary Table Doubles Vertical Capacity of G.&L. Horizontal Boring Machine

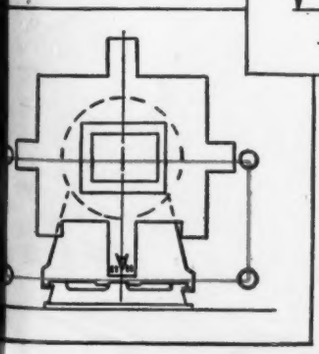
MACHINING A 20-FOOT WELDMENT... WITH 10-FOOT HEADSTOCK TRAVEL

Machining this 20-foot weldment is accomplished by using a vertical table with only 10 ft. center height and a horizontal boring machine having but 10 ft. vertical headstock travel. Work is indexed to bring the top down where it is accessible for milling and other operations. Both work rotation and tool rotation are possible. Using the power rotary table, work may be turned and faced with stationary tools much the same as on a vertical boring mill or on a lathe. Then, work can be milled, bored, drilled and tapped with tools in a rotating spindle in the conventional manner. Again work can be generated by rotating a formed tool in the boring mill spindle, while the work is turned by the rotary table.

An operator of a vertical boring mill working on a piece 20 ft. in diameter is at least 10 ft. away from the cutting tool. The operator of a floor-type horizontal boring machine, shown here, rides on a platform attached to the machine headstock and is at all times immediately adjacent to the cutting tool.

It is a simple matter to increase the range of your own horizontal by equipping it with a vertical rotary table. If you are confronted with similar machining problems, it will be profitable to call on our engineers for assistance. There is no obligation for this help.





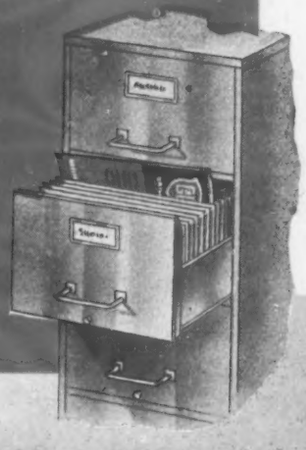
FACE MILL—ONE SET-UP

1ST OPERATION—FACE MILL
Red frame denotes maximum working range of horizontal boring machine spindle, which is the area covered by the vertical and horizontal travel of the headstock and column.

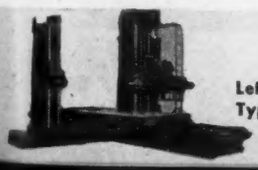
2ND OPERATION—INDEX 180°—FACE MILL
Top portion "A" has now been brought down within working range of spindle.

Additional Data

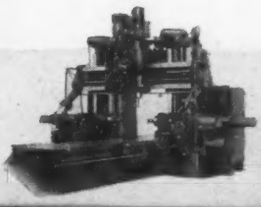
...covering the complete line of Giddings & Lewis machines and time-saving accessories is included in this catalog. Write for your copy today—please indicate your business connection. Ask for Bulletin ST-15.



MACHINE TOOL CO.
FOND DU LAC, WIS.



Left: G. & L. Planer Type Machine.



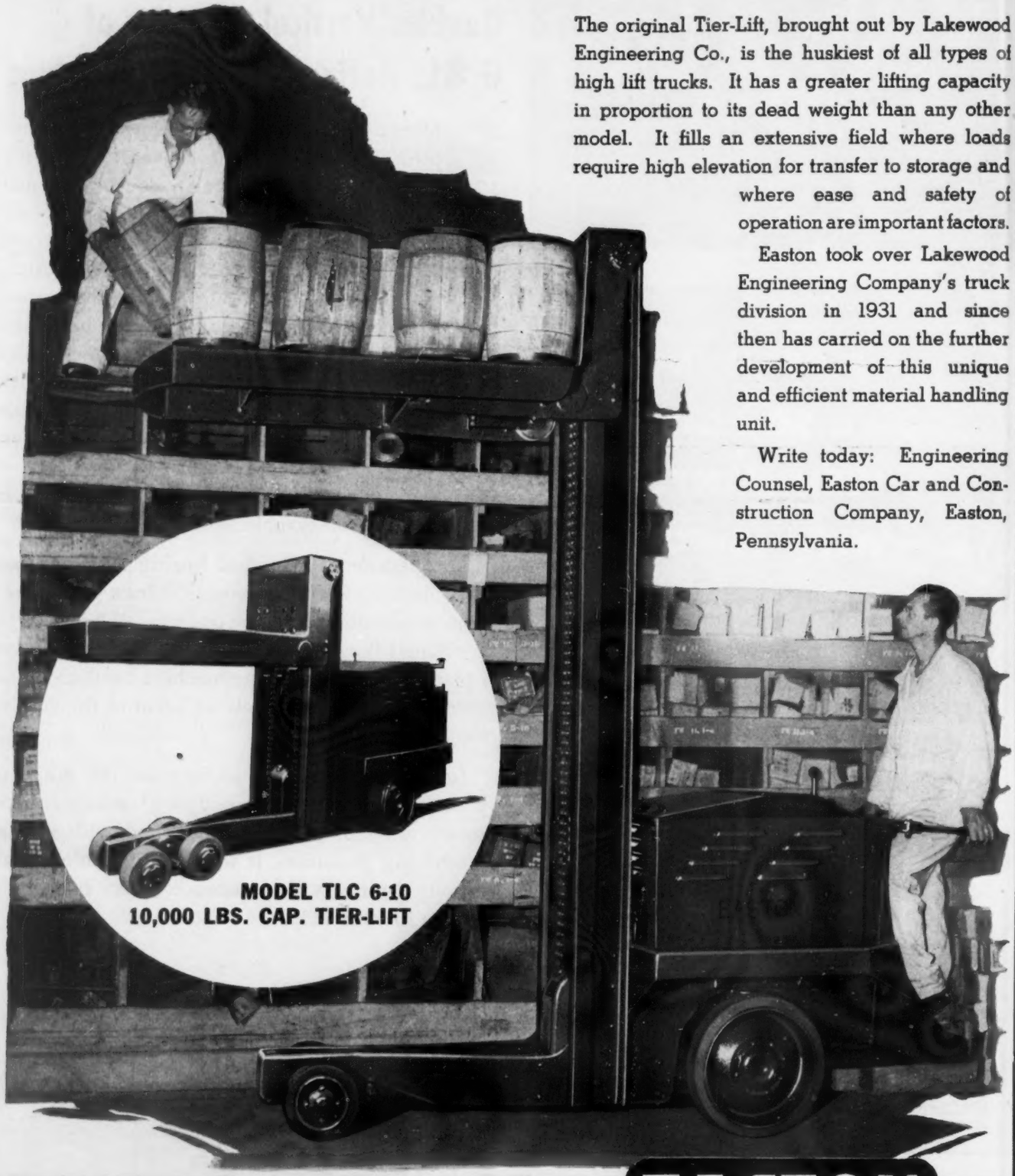
Left: G. & L. Multiple Head Type Machine.

TIER-LIFT 4,000 to 10,000 LBS.

The original Tier-Lift, brought out by Lakewood Engineering Co., is the huskiest of all types of high lift trucks. It has a greater lifting capacity in proportion to its dead weight than any other model. It fills an extensive field where loads require high elevation for transfer to storage and where ease and safety of operation are important factors.

Easton took over Lakewood Engineering Company's truck division in 1931 and since then has carried on the further development of this unique and efficient material handling unit.

Write today: Engineering Counsel, Easton Car and Construction Company, Easton, Pennsylvania.



MODEL TLC 6-10
10,000 LBS. CAP. TIER-LIFT

THE ORIGINAL TIER-LIFT AS NOW BUILT BY

EASTON
INDUSTRIAL CARS
TRUCK BODIES · TRAILERS
ELECTRIC LIFT TRUCKS

A-1007

Greatest V-Belt Show ON EARTH!

EVERY MEMBER OF ALLIS-CHALMERS GREAT NEW V-BELT TEAM IS SPECIALLY DESIGNED, TESTED AND BUILT TO LICK A SPECIFIC DRIVE PROBLEM, SAVE YOU MONEY AND TROUBLE

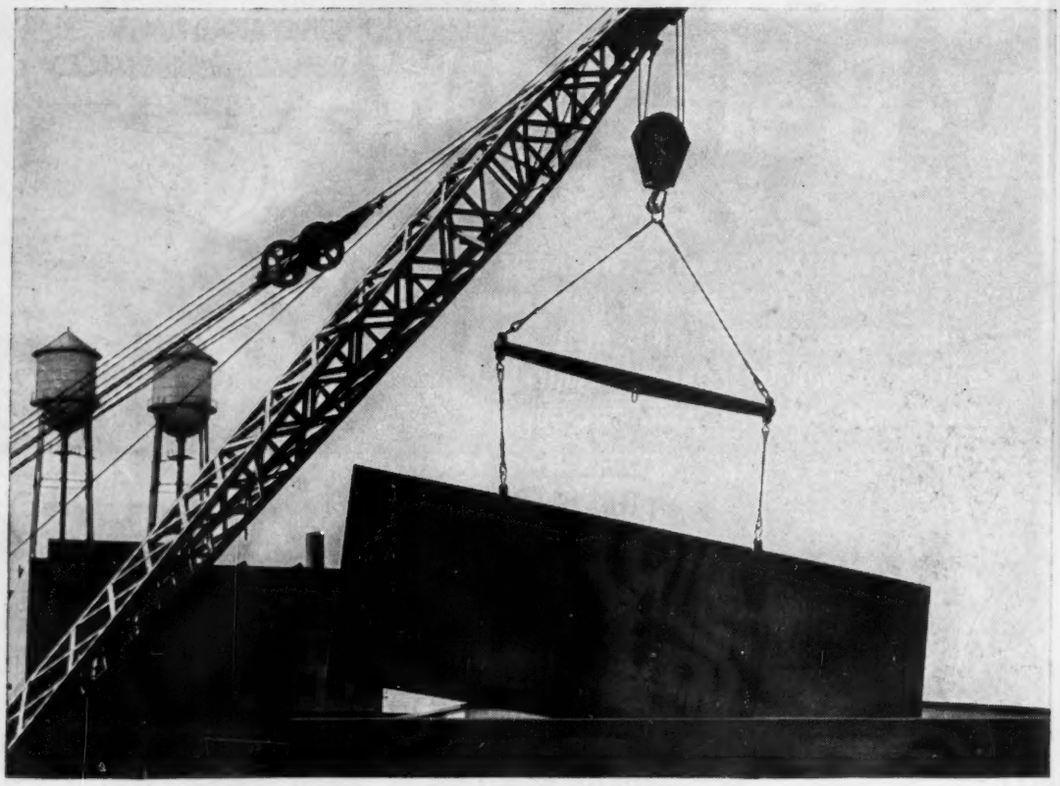
I'M SUPER-7-STEEL... THE STRONG MAN OF V-BELTS. MY STEEL CABLES SUPPLY ADDED POWER... GREATLY REDUCE SLIPPAGE CAUSED BY STRETCH
THIS ISN'T AN ACT. I CAN EAT UP 180°F TEMPERATURES ALL DAY LONG. IF THE HEAT'S ON YOUR DRIVES, CALL FOR HEAT-RESISTING SUPER-7
THEY CALL ME STATIC-RESISTING SUPER-7 BECAUSE I CARRY STATIC CHARGES TO MACHINES WHERE THEY'RE GROUNDED.
DON'T WORRY IF YOUR BELTS MUST PRACTICALLY BATHE IN OIL OR GREASE. JUST ASK FOR SUPER-7 OIL-PROOF. I'M MADE OF IMPERVIOUS NEOPRENE.
OIL
A LITTLE OIL DOESN'T FAZE ME AT ALL. I'M OIL-RESISTING SUPER-7 ... HANDLING 90% OF ALL OILY DRIVE CONDITIONS.

IT PAYS TO MAKE **ALLIS-CHALMERS** YOUR

V-BELT DRIVE HEADQUARTERS

Texrope Super-7 V-Belts result from the cooperative research of two great companies—Allis-Chalmers and B. F. Goodrich—and are sold exclusively by A-C.

for the Everyday Jobs ahead...



Specify TRU-LAY *Preformed*

Regardless of the job at hand or immediately ahead, you'll find that American Cable **TRU-LAY PREFORMED WIRE ROPE** handles easier, reeves faster, lasts longer, is safer for the workmen.

It is the preforming process, scientifically applied at the mill, that endows **TRU-LAY** with high fatigue resistance. Being more flexible than non-preformed, **TRU-LAY** bends easily, is pre-broken-in, resists kinking and whipping, spools better. Being free of internal stresses, **TRU-LAY** does not squirm or rotate in sheave grooves. This saves both rope and sheaves. The preforming process has enabled rope to set new and higher standards of service, and **TRU-LAY** is the original preformed wire rope. Specify **TRU-LAY PREFORMED** for your next line.

AMERICAN CABLE DIVISION

Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, Portland, San Francisco, Tacoma

AMERICAN CHAIN & CABLE • BRIDGEPORT

ESSENTIAL PRODUCTS • TRU-LAY Aircraft, Automotive, and Industrial Controls • TRU-LOC Aircraft Terminals • AMERICAN CABLE Wire Rope • TRU-STOP Brakes • AMERICAN Chain • WEED Tire Chains • ACCO Malleable Castings • CAMPBELL Cutting Machines • FORD Hoists, Trolleys • HAZARD Wire Rope • MANLEY Auto Service Equipment • MARYLAND Bolts and Nuts • OWEN Springs • PAGE Fence, Shaped Wire, Welding Wire • READING-PRATT & CADY Valves • READING Steel Castings • WRIGHT Hoists, Cranes • WILSON "Rockwell" Hardness Testers

In Business for Your Safety

WHERE LIMITED STORAGE SPACE NECESSITATES *High Piling*

● Getting the most out of small store yard space or handling heavy loads in concentrated areas at loading or unloading points calls for versatility in material handling machinery. These are the places for Northwest Crawler Cranes. Northwest Crawler Cranes handle jobs that no other type of material handling equipment can handle.

Northwests go anywhere. They pile high or low. They handle any type of material handling attachment from Hook Block to Magnet. They will unload any type of material. They can be adapted to unload practically any type of conveyance and they can be equipped to work inside or outside and with any modern form of power.

Northwests are serving in the plants of some of the Nation's largest manufacturers handling everything from coal and ashes at the power plant to steel and scrap in the store yard. Your Northwest will always be busy cutting costs in ways you never dreamed of. Let us tell you in detail how others are using them. Ask for details on Northwest advantages and Northwest application.

NORTHWEST ENGINEERING CO.
1805 Steger Bldg., 28 E. Jackson Blvd.
Chicago 4, Illinois

OTHER THINGS A NORTHWEST WILL DO!

- Handle coal and ashes.
- Load and unload any kind of conveyance.
- Handle any type of material, loose or solid.
- Handle magnet for scrap, turnings and borings.
- Goes any place to make out-of-the-way corners of the yard usable.

BUILT IN A RANGE OF 18 SIZES — 4½ TONS CAPACITY AND LARGER

Let's get acquainted INVESTIGATE THIS *Different* CRAWLER CRANE

NORTHWEST

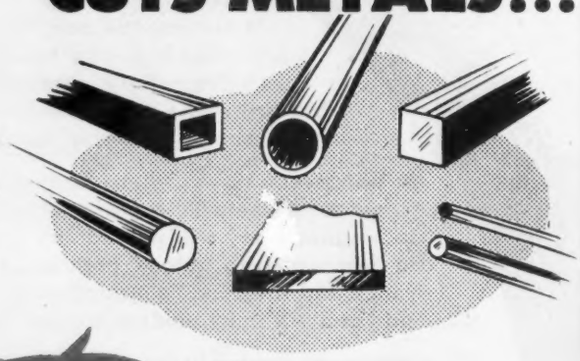
The Crane that goes Anywhere!

Wells No. 8

SPECIFICATIONS
WELLS No. 8

CAPACITY: Rectangular	8"x16"
(Special Guides)	5" x 24"
ROUNDS:	8" diameter
MOTOR:	½ H. P., current optional
SPEEDS:	Selective 60, 90, 130 feet per minute
WEIGHT:	Approximately 750 pounds

CUTS METALS...



CUTS *Costs* TOO!

There's no doubt about it. For economical metal cutting, this Wells No. 8 is hard to beat. Because of its flexibility you can use it for your odd cutting jobs and free large production units for other work.

It cuts quickly, and with a minimum of labor. The quick acting vise handles odd shapes without special fixtures. It's accurate. And, it affords a substantial material saving as the saw removes only 45 thousandths of an inch of material.

Another reason why the Wells cuts costs is its portability. You save time and labor by moving the saw to the work.

Thousands of Wells Metal Cutting Band Saws are working in busy plants. Check up. You'll find a spot in *your* plant for a Wells No. 8.

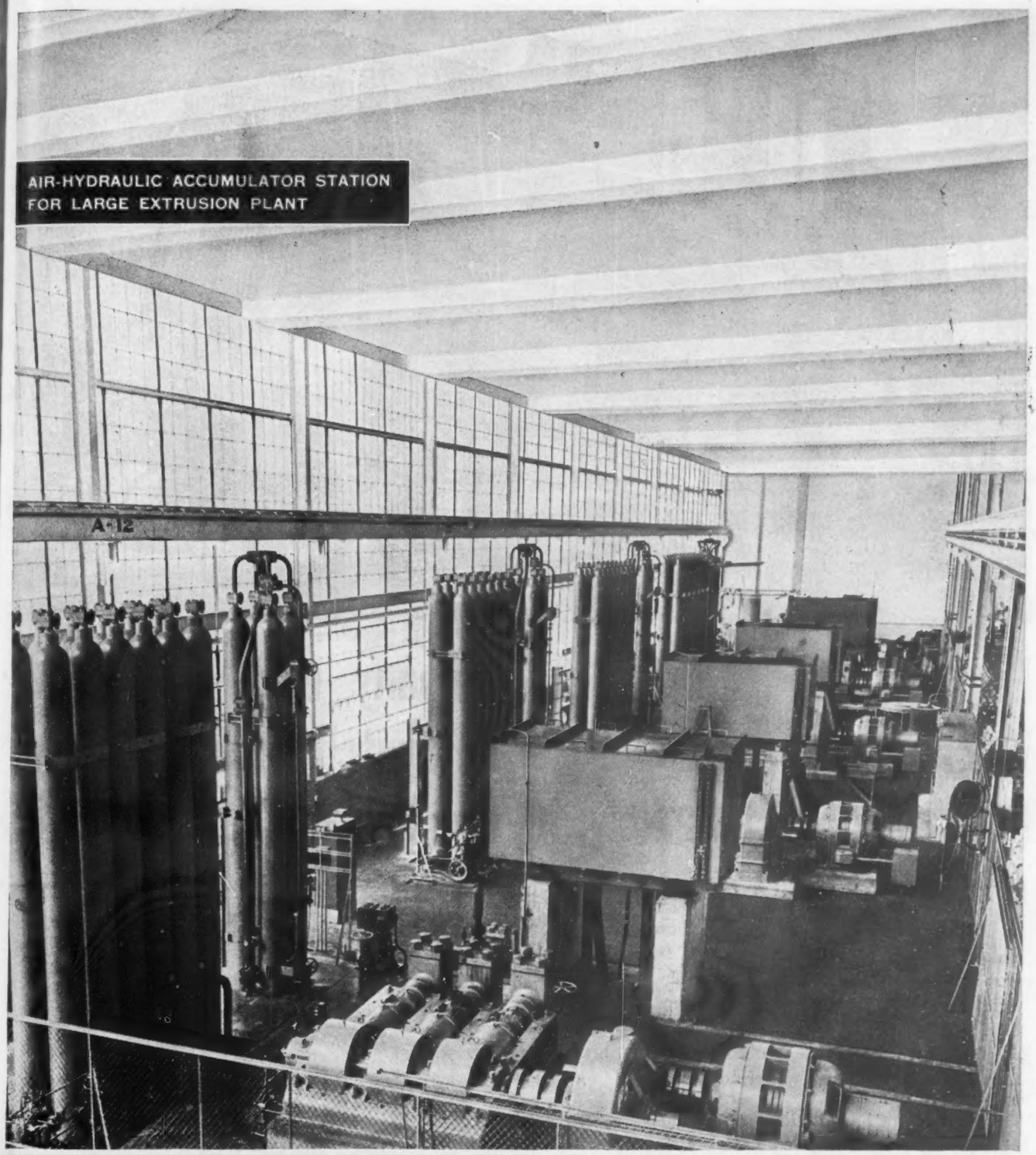
Wells SAWS
THE SIGN OF SERVICE

Wells

Products by Wells are Practical

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION
1515 FILLMORE ST., THREE RIVERS, MICHIGAN



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For 35 Years the Frick Company used the Same Vulcan Steam Locomotive to Switch Railroad Cars. Now they use this New 50-Ton Vulcan Diesel-Electric

WHEN the Frick Company—world-famous manufacturers of refrigerating and air-conditioning equipment—recently decided to purchase a new Diesel-Electric Switcher, it was natural that they should turn again to the same organization that had served them so well more than a third of a century ago. And we welcomed the opportunity to give them our best possible service again—because that's how Vulcan has steadily grown larger and stronger: for nearly a hundred years.

The locomotive here illustrated and described is especially suitable for the Frick Company's requirements but we build all types and sizes from 6 to 100 tons: Steam, Electric, Gasoline, Diesel and Diesel-Electric—wide or narrow gauge. More than 5,000 Vulcan Locomotives have gone into service since "Old No. 1" was built in 1874, and our list of users is practically a "Blue Book" of leading mining and industrial organizations throughout the United States and many other countries.

Deliveries are still subject to approval of the War Production Board but inquiries are cordially invited and our experienced engineering executives welcome all opportunities to cooperate in either the selection of standard-type locomotives or in the development of any necessary special features.

WORKING DATA

for 50-ton locomotive illustrated above

PERFORMANCE

Tractive Effort, starting, lbs. (30% adhesion, with sand)	30,000
Tractive Effort, continuous, lbs.	10,800
Speed at continuous T.E., M.P.H.	7.5
Maximum Safe Speed, M.P.H.	20.5

ELECTRICAL EQUIPMENT

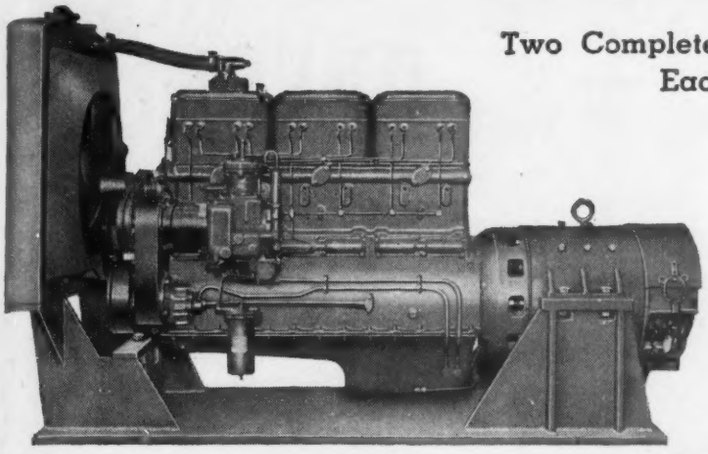
Generators, Two, Westinghouse Type 189-R7, 300 Volts, D. C.
Motors, Two, Westinghouse Type 1443-A, 300 Volts, D. C.
Motor Gear Ratio, 21.4 to 1.
Control, Westinghouse Single-Station Electro-Magnetic.

MECHANICAL EQUIPMENT

Engines, Two, Full Diesel, rated 150 hp. at 1800 R.P.M.
Brakes, Westinghouse Straight and Automatic, Schedule 14-EL.
Compressors, Two, each 34 C.F.M., mechanically driven.

DIMENSIONS

Track Gauge	4'-8½"
Truck Wheel-Base	5'-0"
Length, over bumpers	27'-8"
Width, over all	9'-5"
Height, over all	11'-6"
Wheel Diameter	33"



Two Complete Diesel-Electric Power Units, Each Mounted on a Heavy Steel Sub-Base

Each of the two power units comprises a 6-cylinder full Diesel Engine, rated 150 hp. at 1800 R.P.M., direct connected to a Westinghouse D.C. Generator. By mounting each complete unit on a powerful steel sub-base, as here illustrated, all parts are made readily accessible for cleaning, inspection and minor repairs. When a major overhaul eventually becomes necessary the entire assembly can easily be lifted out and replaced.

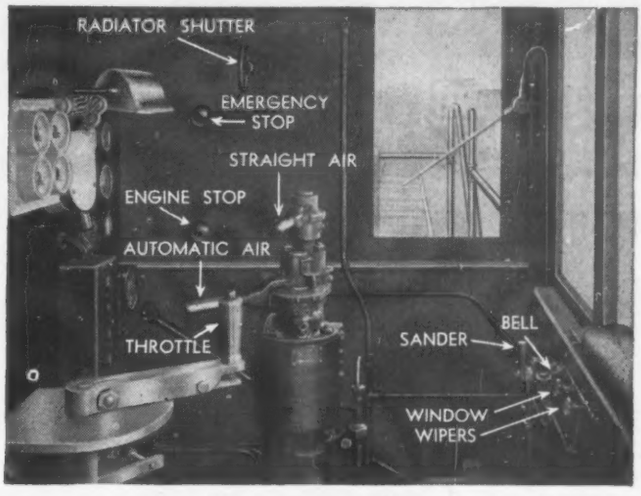
The main generators are equipped with starting windings for cranking the Diesel engines; power for which is supplied by a lead-acid-type storage battery of ample capacity. Small auxiliary generators—one on each engine—keep the storage batteries fully charged and supply adequate power for lights, controls, etc.

Convenient One-Man Control with Good Visibility in All Directions

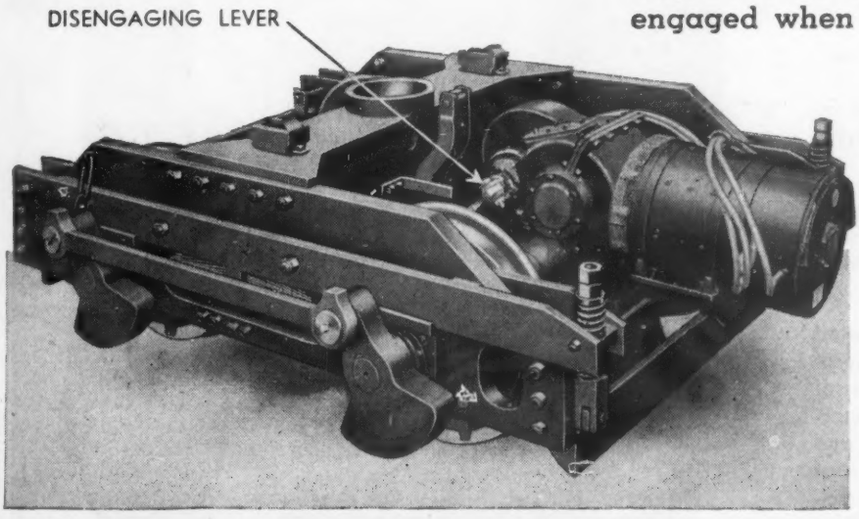
The roomy cab has large windows on all four sides, giving good visibility in all directions, and the Westinghouse Single-Station Electro-Magnetic Control makes operation extremely simple; the engineer using only a throttle and reversing lever to control speed and direction of motion. The Westinghouse Straight and Automatic Air Brakes are equally easy to apply and can always be relied upon for a quick smooth stop when necessary.

As shown in the accompanying illustration, the throttle and the two brake levers are all grouped closely together and so located that the engineer can reach any of them conveniently with one hand, whether running the locomotive forward or backward.

Window Wipers are of unusually sturdy construction and are operated by compressed air from the main reservoir as are also the Sanders and Bell. Control valves are located for convenient operation by the engineer whether running forward or backward.



Triple-Reduction Gears Easily and Quickly Disengaged when "Free-Wheeling" is Necessary



With its high-speed, high-efficiency motor raised well above the track and its triple-reduction gears fully enclosed in an oil-tight, dust-proof, cast-steel housing, this compact four-wheel-drive truck embodies every approved feature for heavy-duty yard and switching service at moderate speeds. Its high gear ratio (21.4 to 1) gives ample power to slip the wheels under excessive load; thereby preventing stalling of the motor.

An exclusive Vulcan feature is the readily accessible "Disengaging Lever" which, when rotated through 180°, disengages the reduction gearing; thereby permitting the locomotive to be towed at high speeds without injury to the gears, bearing or armature windings.

Positive four-wheel drive on each of the two trucks is attained by the use of forged-steel solid-end side rods which are accurately counter-balanced and set 90 degrees apart.

VULCAN IRON WORKS

Modern CLEVELAND *Four Point* PRESSES *for*

DEPENDABILITY

LOW MAINTENANCE

ECONOMY of PRODUCTION

ACCURATE PRODUCTION of DUPLICATE PARTS

The Power Press of today is no longer considered just a heavy piece of machinery arranged with cumbersome and unsightly overhanging brackets and projections.

It is a Modern machine tool of neat, compact appearance designed to provide dependability, low maintenance, economy of production and the accurate production of duplicate parts.

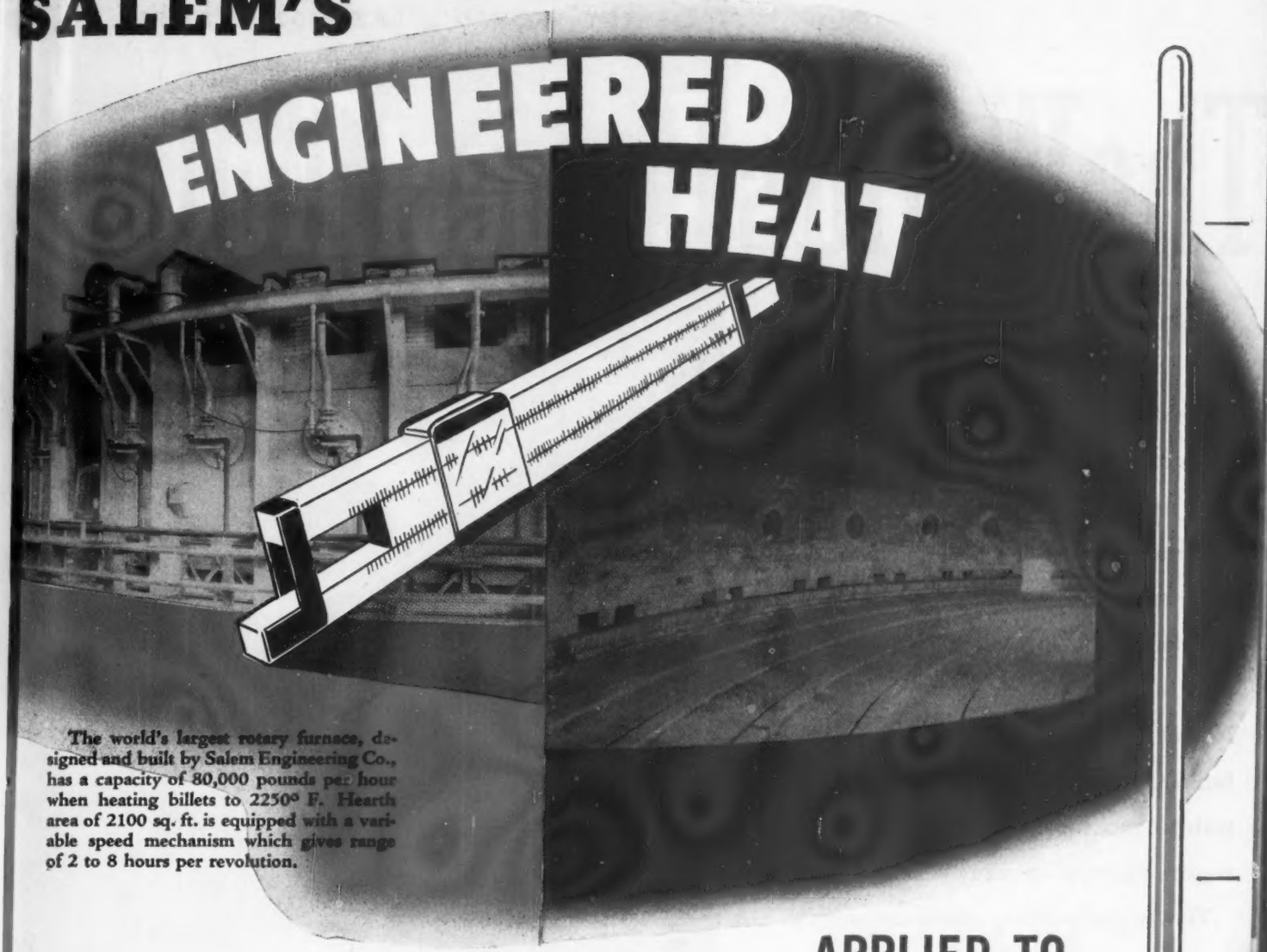
When built to conform to modern engineering standards of design and construction, it embodies greater strength and ruggedness with greatly reduced weight.

The Cleveland Four Point Press illustrated which has a capacity of 750 tons, is one of a series of three types of Modern Presses known as Single Point, having one connection: Two Point, having two connections and Four Point, having four connections, each of which can be furnished in sizes and capacities to suit particular requirements.

THE CLEVELAND PUNCH AND SHEAR WORKS COMPANY

CLEVELAND, OHIO

SALEM'S ENGINEERED HEAT



The world's largest rotary furnace, designed and built by Salem Engineering Co., has a capacity of 80,000 pounds per hour when heating billets to 2250° F. Hearth area of 2100 sq. ft. is equipped with a variable speed mechanism which gives range of 2 to 8 hours per revolution.

. . . . . APPLIED TO THE WORLD'S LARGEST ROTARY FORGE FURNACE

SALEM'S Engineered Heat combines engineering with economics to produce an efficient and profitable heat treating installation for the customer.

For instance, consider the case of the world's largest rotary forge furnace, 2100 sq. ft. of hearth area, designed and built by Salem Engineering Company.

Our engineers had no precedent as a guide. They simply knew that costs on the customer's sloping hearth furnace for heating round billets up to 10" in diameter and lengths up to 12', had been much too high.

The Salem rotary, in more than two years of operation, has saved the customer an average of 2% in scale loss alone. It has relieved six men per turn for other work, and the maintenance cost has been low.

The operating men and Salem's engineers attribute the performance to sound design plus unique mechanical features.

Learn how Salem's Engineered Heat plan can cut your heat treating costs.

Send your inquiry to Salem Engineering Company at Salem, Ohio.

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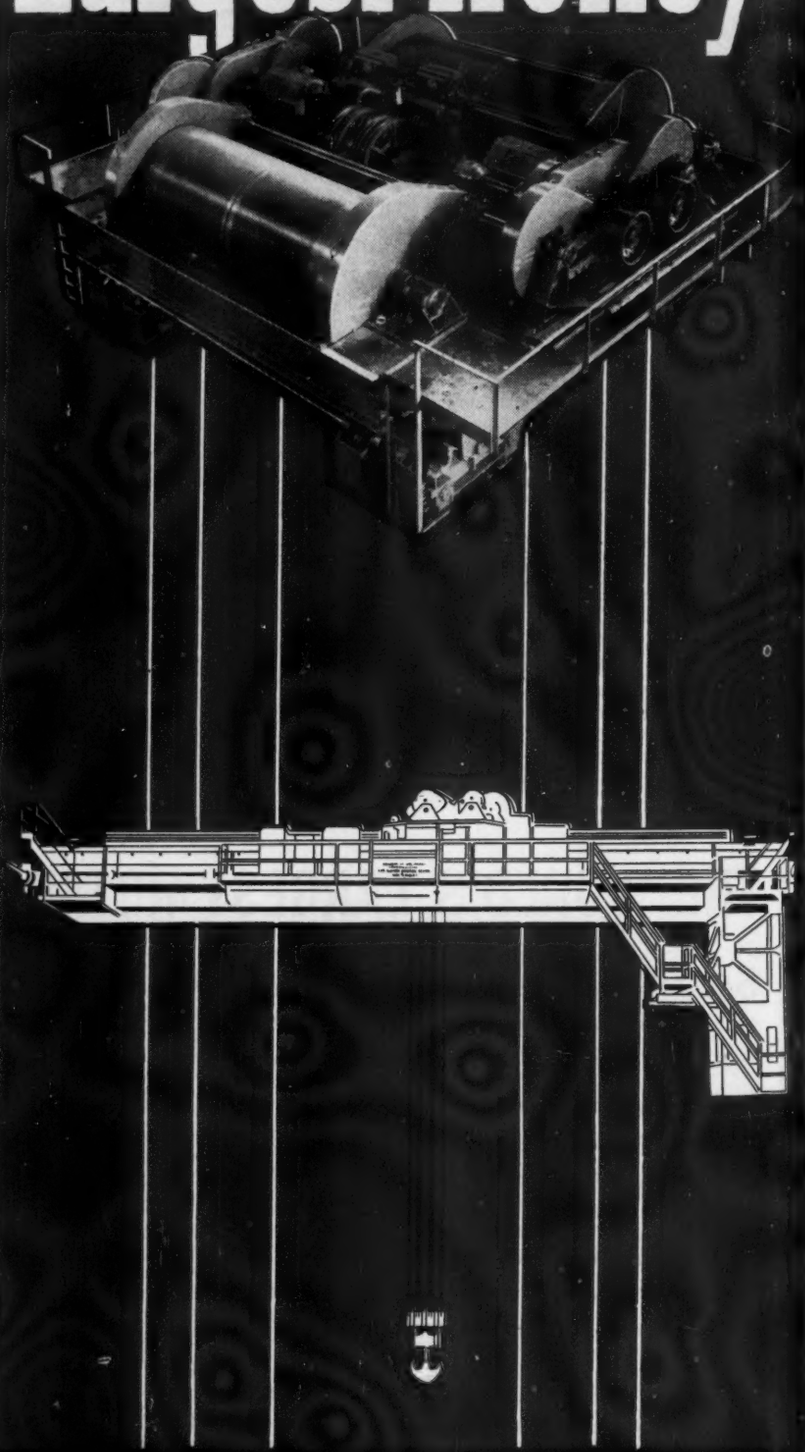
SALEM **SALEM** OHIO

ENGINEERING CO.

SALEM ENGINEERING COMPANY

The World's Largest Trolley



Drafted for service in World War I. three of these 336 ton 90' 0" span cranes now have a service record of 27 years without furlough.

When the present world conflict called for increased facilities to equip our forces with the necessary armament, it was only logical that Alliance would be asked to furnish *exact duplicate cranes,* as the maintenance record showed practically no repairs during their many years of service.

Five of these lifting giants are now carrying the war loads for Uncle Sam.

These cranes have multiple drums, high speed lowering on the auxiliary hoist, and are designed for a lift of 100 feet.

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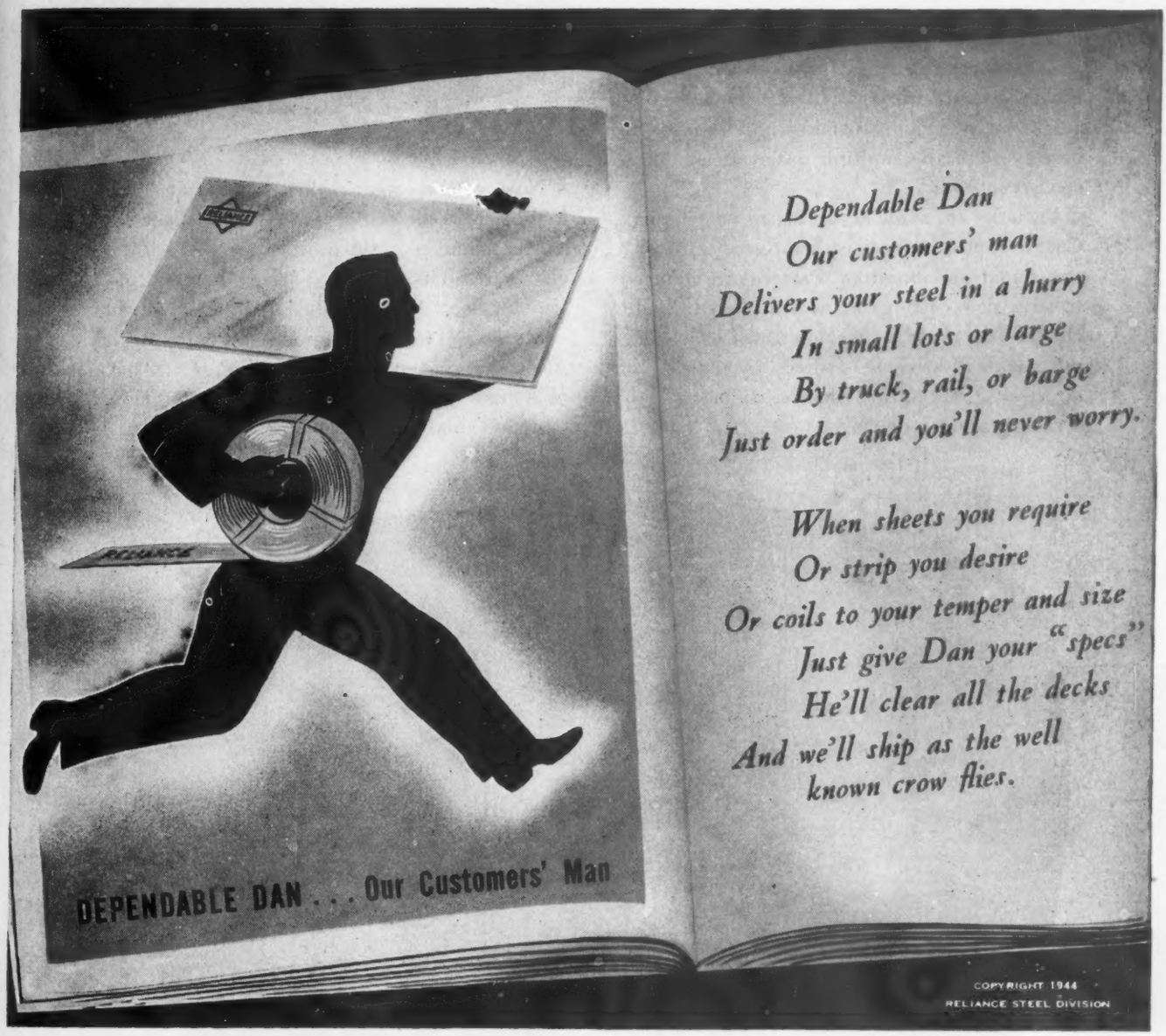
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In small lots or large
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Just order and you'll never worry.
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Just give Dan your "specs"
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And we'll ship as the well
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What's a pattern maker got to do with **ALUMINUM FORGINGS?**

You've decided on an aluminum forging because of its high strength-weight ratio. But stresses will be complex. You can't be sure of the design until the part is completed, and dies cost a lot of money to make and change. So here's where the multiple interests of Alcoa can serve you:

Patterns are made according to your design. Cast in sand, the piece is then tested in Alcoa's stress analysis laboratory. Patterns are changed to suit, new castings made and tested. Slight changes are made by machining off or welding on metal. When the desired distribution of stresses is obtained, Alcoa's engineers say, "There's your design".

Now we make the forging dies. Because the forging has the same shape and a similar elastic modulus as the casting, stresses will be distributed alike. Alcoa pattern makers and foundrymen, skilled in their arts, have saved you time and money by thus co-operating with Alcoa's forging engineers. ALUMINUM COMPANY OF AMERICA, 2112 Gulf Building, Pittsburgh 19, Pennsylvania.

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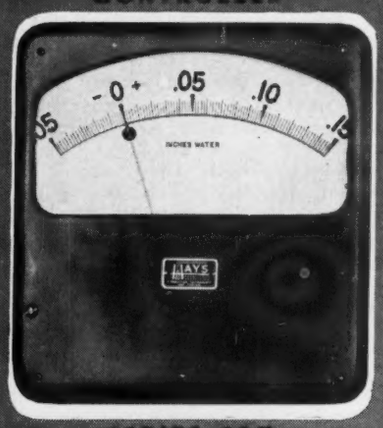
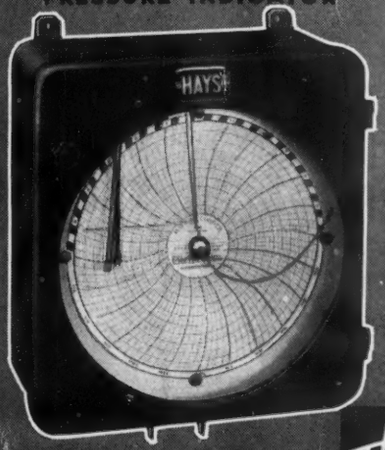
A Real Aid to PRODUCTION

TYPE CDE-X
FURNACE PRESSURE
CONTROLLER



SERIES FOT
PRESSURE INDICATOR



SERIES OT
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HAYS
OPEN HEARTH PRESSURE CONTROL

TONNAGE can be increased through more even operation and even operation also means fuel saving. Automatic control of furnace pressure, rates of fuel and air flow, ratio of fuel to air, constant volume or pressure of oil or gas relieves the operators of many time-consuming details, allowing them to pay more attention to the steel making process.

When desired, the control of these various functions can be handled manually from a centralized panel through remote operation. Hays control is all-electric, simple to install, simple to operate, simple to understand.

The following Hays instruments may be used effectively in combination or separately for the functions indicated.

Type CDE-X Furnace Pressure Controller with external manual adjustment for automatically operating stack damper to hold pressure constant.

Series FOT Pressure Indicator provides an easily read measurement of furnace pressure. Usually connected at furnace roof.

Series OT Pressure Recorder provides daily record (24 hr. chart) of furnace pressure. Shows timing of reversals and each change of pressure made by operator during the heat.

Hays partial or complete instrumentation is a REAL AID TO PRODUCTION. Hays representatives located in the principal cities of the U.S.A. and Canada will gladly supply complete information.

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SINCE 1901
COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A.

SEND FOR THIS TEST PANEL

See for yourself how Iridite licks corrosion problems, adds lasting beauty to zinc or cadmium plating.

MAIL the coupon below for this free test panel of Iridite-protected zinc plating. Have your laboratory give it any corrosion test you want. Watch Iridite "take it" and come back for more. Then you'll see for yourself why Iridite is so widely used as a corrosion-resistant final finish by such manufacturers as Western Electric, Otis Elevator, Bulova, Pyrene, Anaconda and many others.

Watch, too, as you're testing it, how the color holds up . . . remains a uniform shade. And remember, Iridite is available in a wide range of colors, adding to products the sales appeal that comes from attractive appearance. Also, because of Iridite's excellent qualities as a paint base, all colors can be clear-lacquered for even greater durability!

Finally, in running your tests, bear in mind the simplicity of the Iridite process. Applied by brief dipping at normal shop temperature, Iridite dries in a few seconds, permits immediate handling, packing and shipping. No slowing up of fast-moving production lines working to fill war or civilian orders! No wonder so many manufacturers specify Iridite for the zinc or cadmium surfaces of their present and future products!

SEND FOR YOUR SAMPLE TODAY

Here's the coupon that will bring you a free sample to test in your own laboratory . . . with *your* products in mind. We urge you to mail it today . . . and see for yourself that widely-specified Iridite can be just the right "finishing touch" for *your* products.

QUICK FACTS ON IRIDITE

Corrosion Resistant. Iridite unites chemically with zinc or cadmium, forms a corrosion-resistant surface.

Firm Paint Base. Iridite holds paint permanently—prevents formation of that soapy, chalky under-layer that destroys adhesion.

Dimensions Unaltered. The Iridite process does not alter dimensions of the most finely machined or delicately articulated parts. Assemblies function as smoothly after Iridite treatment as before.

Completely Flexible. Iridited parts may be bent or twisted without flaking, chipping or peeling.

Easy to Apply. Iridite is applied by simple dipping immediately after the last rinse tank in the plating line. Parts dry in a few seconds, permitting immediate handling, packing and shipping.

Many Attractive Colors. Currently available are blues, greens, maroons, bronze, olive drab and black. All colors can be clear-lacquered for even greater durability.

Rheem Research Products, Inc.,
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Gentlemen: Please send me a free sample of Iridite-treated zinc plating for laboratory testing, together with full information and operating details.

Name.....

Company.....

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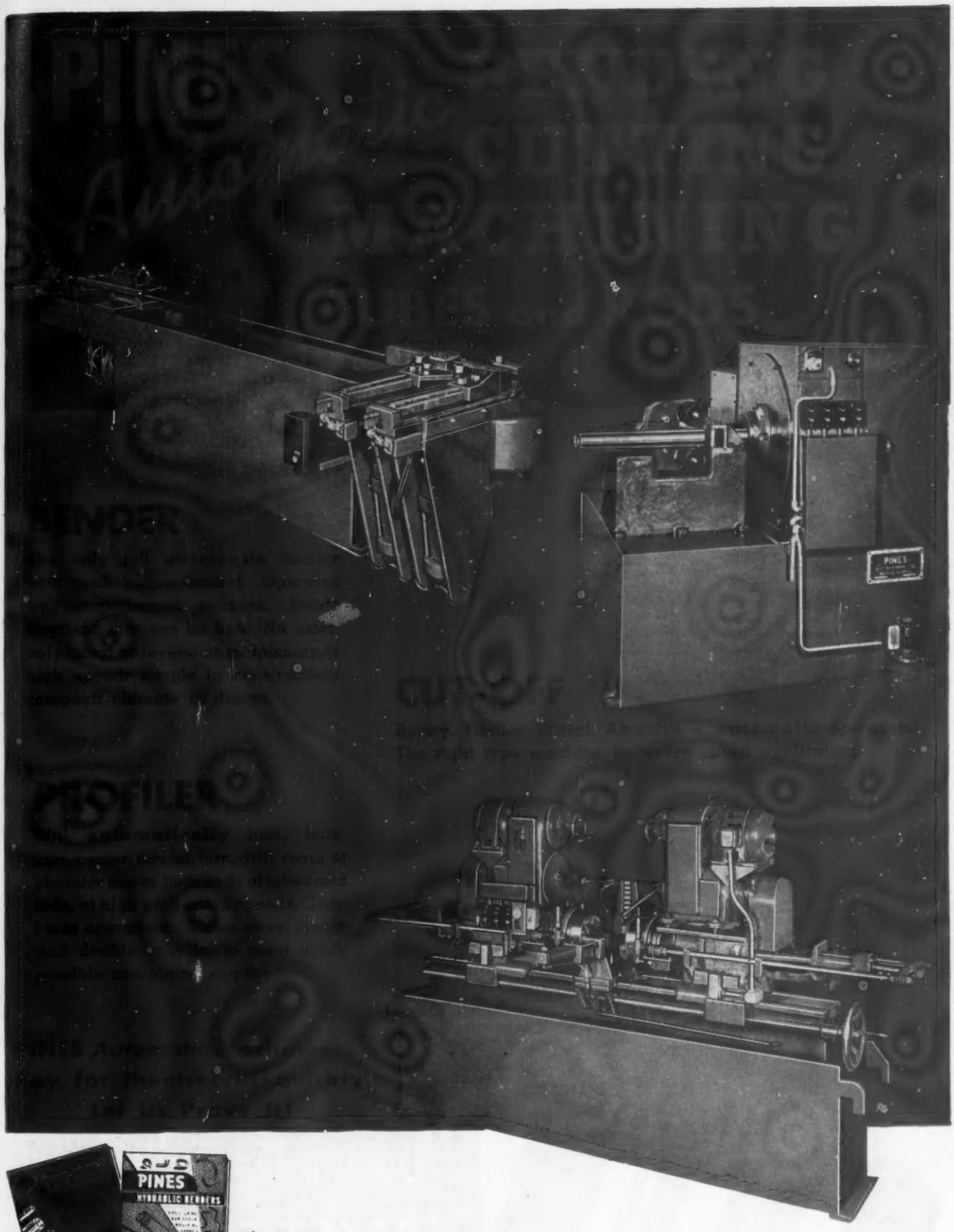

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Greater holding power – resistance to severe stresses – these are two of the many good reasons for using Socket Screws in your product assembly.

That's why it's good judgment to choose Socket Screws that give you predetermined assurance of dependable strength – screws held to exacting standards of trouble-free performance by Parker-Kalon's Quality-Control routine.

Unequalled in the industry for scientific thoroughness, this continuous check-up of every mechanical and physical characteristic rules out "doubtful" screws – screws that *look* all right, but some of which fail to work right. Tests and inspections cover Chemical Analysis; Tensile and Torsional Strength; Ductility; Shock Resistance under Torsion and Shear; Hardness; Head and Socket Size; Thread Fit.

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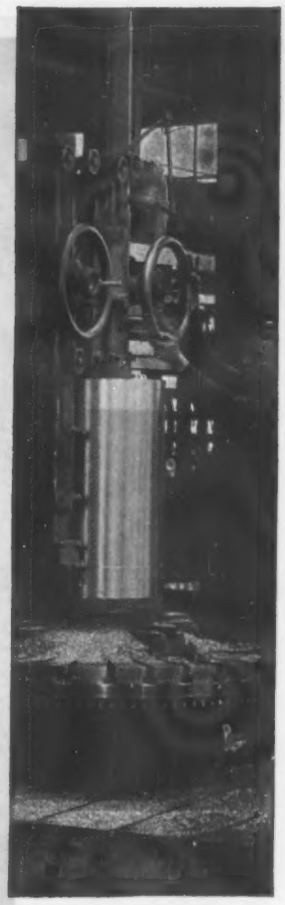
You Waste Less Metal



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SHENANGO-PENN specializes in centrifugal castings of bronze, iron alloys, and many special alloys of aluminum and manganese bronze, nickel silver, and other ferrous and non-ferrous metals. The density of our centrifugally cast metal makes it possible to leave a minimum of metal for finishing (sometimes as little as 1/16 of an inch in smaller castings). This means valuable savings of critical metals. Finishing costs and finishing time are also reduced.

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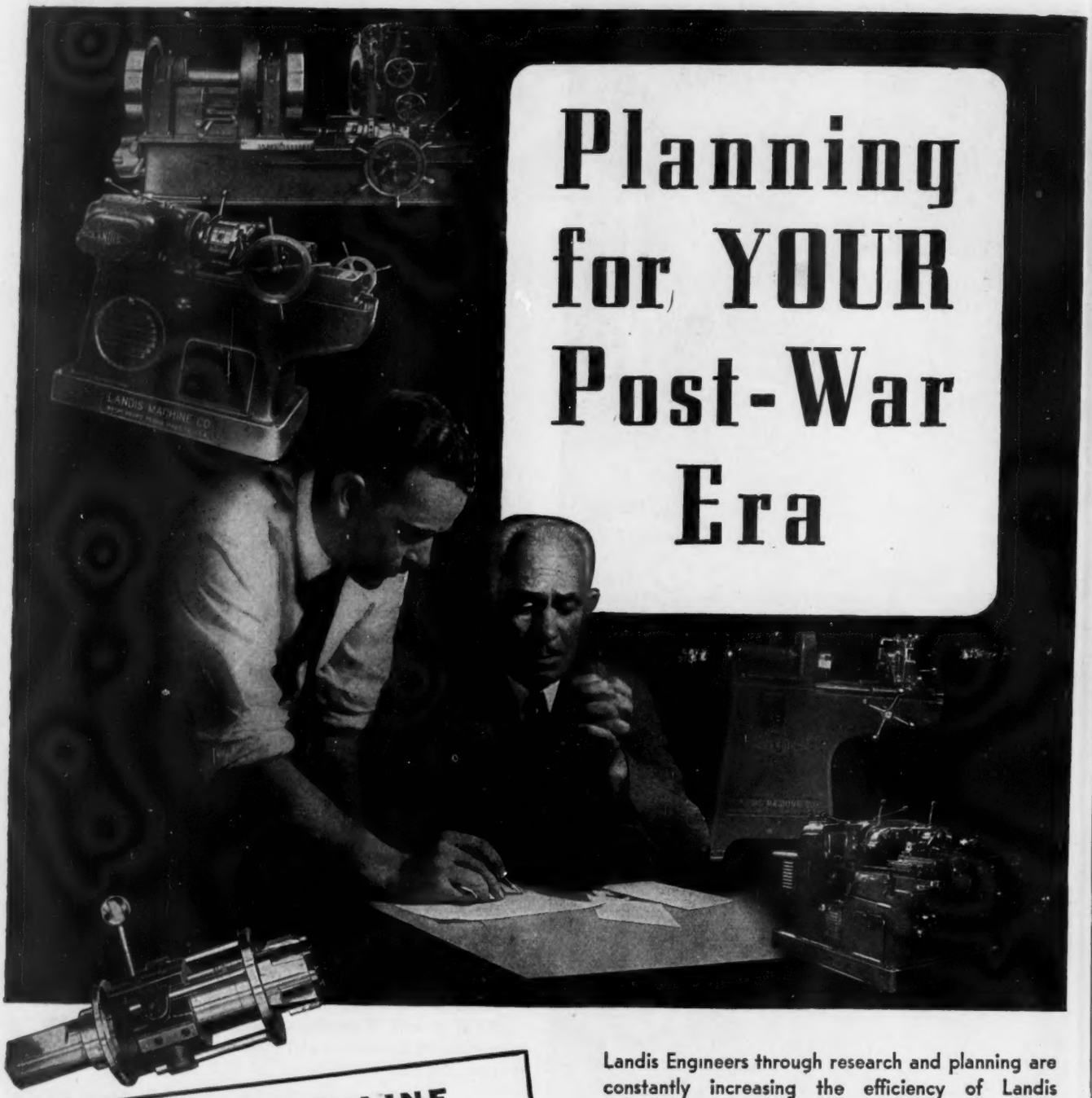

Planning for YOUR Post-War Era

The LANDIS LINE

THREAD CUTTING MACHINES
- Landmaco Threading Machines
- Bolt Factory Threaders
- Automatic Forming and Threading Machines
- 4 Spindle Semi-Automatic Threading Machines
- Pipe and Nipple Threading Machines

THREAD CUTTING DIE HEADS
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- Landex (for Automatic Screw Machines)
- Lanco (for Automatic, Semi-Automatic and Hand-Operated Threading Machines)
- Lanco Pipe and Nipple Threading Heads
- Stationary Pipe Die Heads
- Reverse Taper Die Heads
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CHASER GRINDERS

COLLAPSIBLE AND ADJUSTABLE TAPS

Landis Engineers through research and planning are constantly increasing the efficiency of Landis Threading Equipment in Threading Production.

The research necessary to keep pace with the tremendous demand of war production has brought forth many improvements which will greatly benefit post-war production.

In the post-war era—as in the war period—Landis is ready to meet your threading demands.

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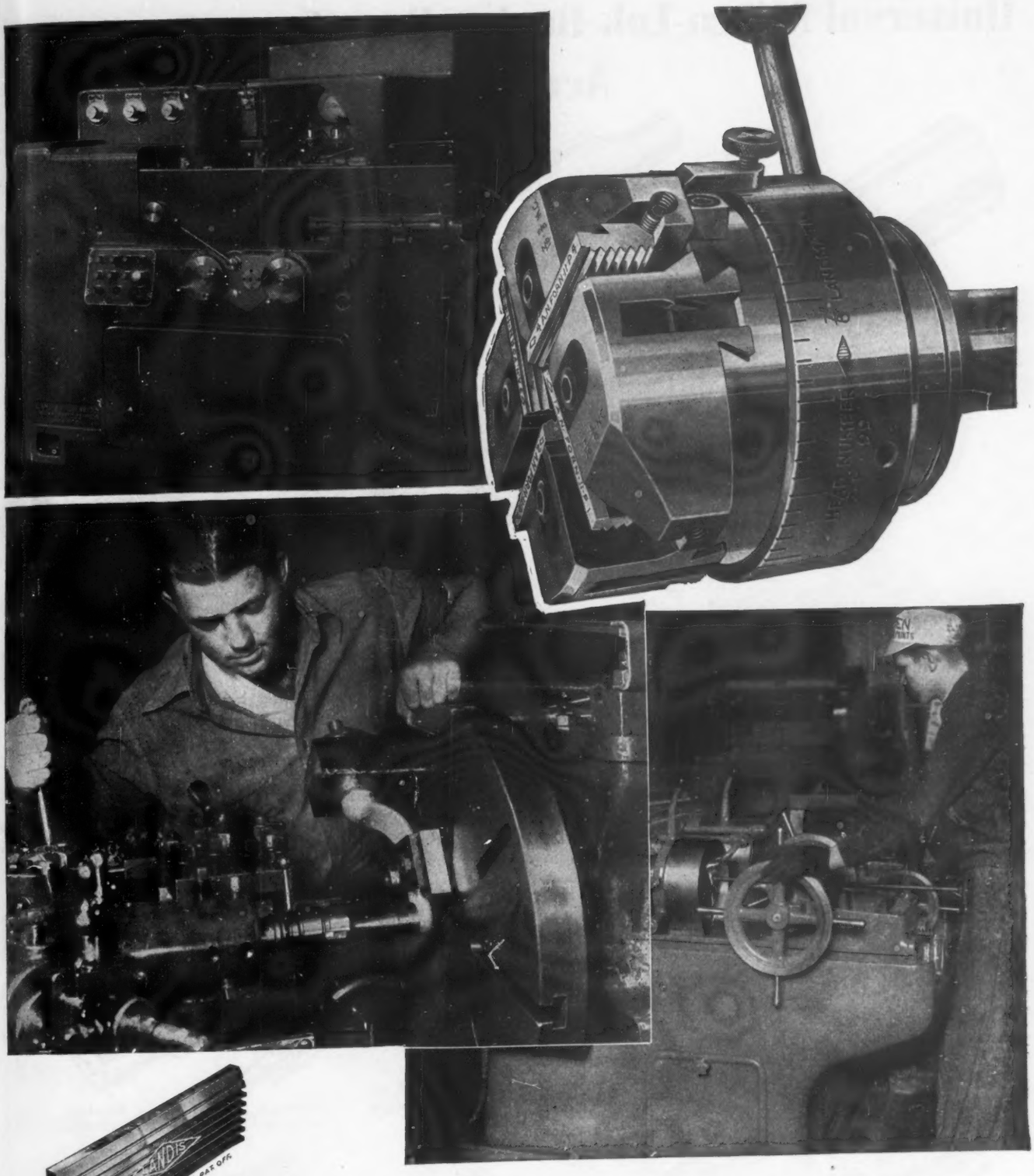
"BE THREADWISE"



THE LANDIS CHASER ... *The Finest Thread Cutting Tool in Industry*

LANDIS MACHINE COMPANY

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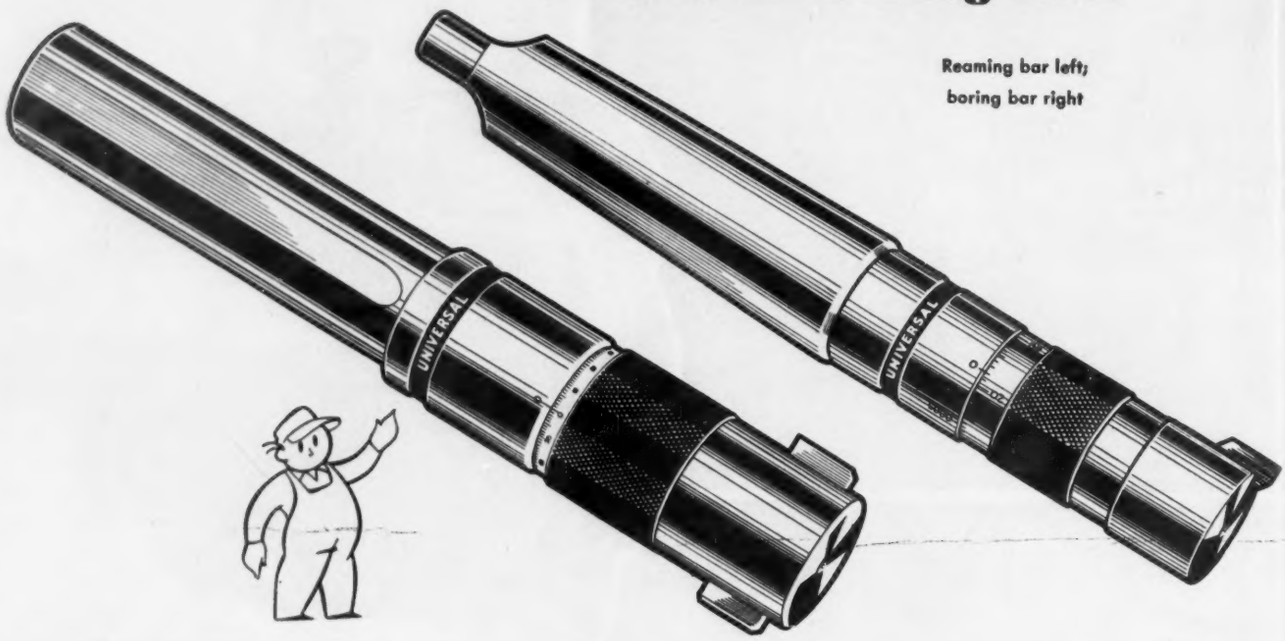
Universal Mikro-Lok Boring Bars for Accurate Finishing Cuts



Reaming bar left; boring bar right

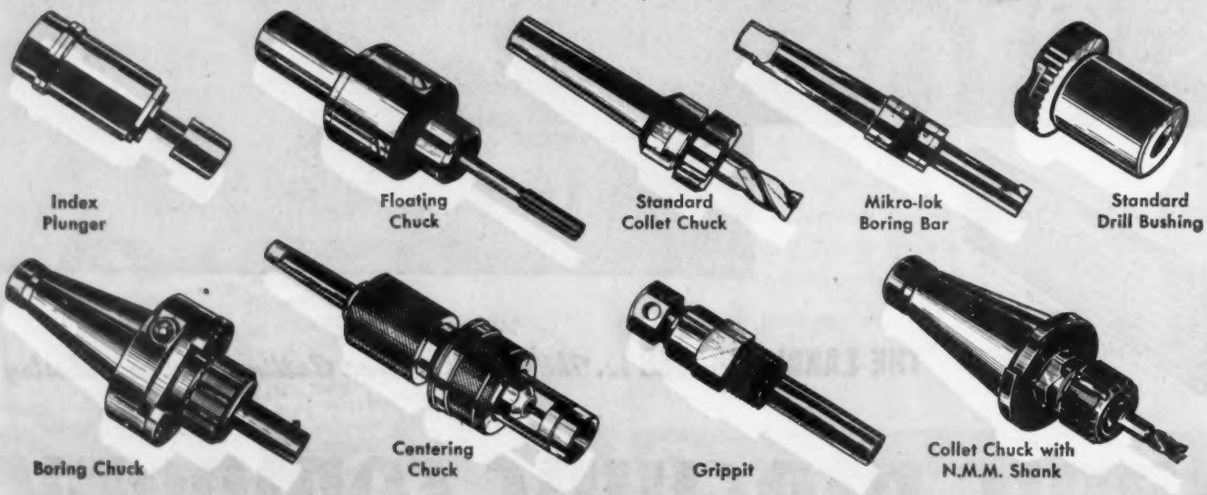
Universal Mikro-lok boring and reaming bars are the perfect tools for finishing cuts with extreme accuracy. They are especially adapted to boring to a shoulder, or to the bottom of a hole or for taking intermittent cuts.

A micrometer-like dial, easily and quickly adjusted, operates a unique mechanism which accurately sets the tool cutting edge to the required size. You can depend on the micrometer graduations to within .0005 inches. Rigid construction protects its accurate adjustability.

Universal Mikro-lok boring bars may be used effectively for light roughing cuts, semi finishing, and finishing cuts in one set-up. Available singly or in sets with Morse taper shanks or Swiss tapers for Jig Boring Machines, and special shanks and flanges for Diamond Boring Machines or other applications. Prompt delivery.

Write for information about these or any of the other Universal precision tools illustrated here.

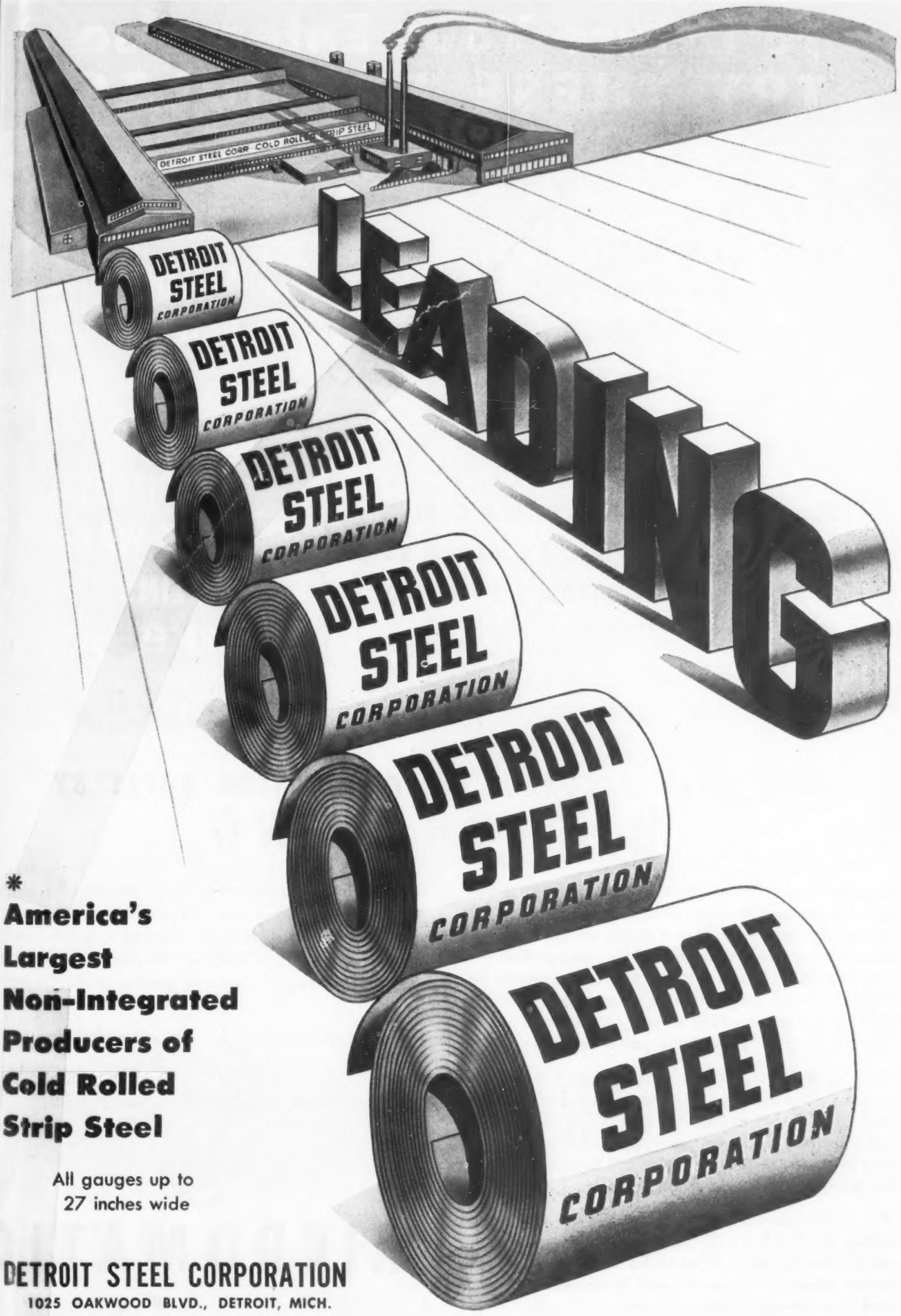
UNIVERSAL TOOLS THAT WILL INCREASE PRODUCTION AND ACCURACY IN YOUR PLANT



UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH, MICHIGAN

FIGHTER PLANE GIVEN BY EMPLOYEES 20% EMPLOYEES BOND DEDUCTIONS



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America's Largest Non-Integrated Producers of Cold Rolled Strip Steel

All gauges up to 27 inches wide

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1025 OAKWOOD BLVD., DETROIT, MICH.

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TODAY'S and TOMORROW'S LABOR RATES
TODAY'S and TOMORROW'S OVERHEAD
= PROHIBITIVE SELLING PRICES

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NEW, MORE PRODUCTIVE TIME COST
TODAY'S and TOMORROW'S LABOR RATES
TODAY'S and TOMORROW'S OVERHEAD
INCREASED QUALITY
= PROFITABLE POST-WAR SELLING PRICES

RING GAGE ACCURACY AT PRODUCTION RATES BY
MICROHONING

Microhoning offers to industry a new tool with which to meet post-war demands for better products at moderate cost—at possibly increased labor rates. A process of final machining, **Microhoning now assumes added responsibility—it removes from .010 to .030 stock under automatic sizing control. By providing ring gage accuracy *at production speeds*, it offers a way of using the second formula to achieve profitable post-war prices.**

It will correct error in bores, or on cylindrical or spherical surfaces, either before or after heat treating—providing form and size accuracy to "tenths." In removing stock, it does not cause heat cracks. By removing distorted surface metal and cracks left by previous operations, it eliminates two of the most frequent causes of fatigue failure.

This modern abrading process also provides any desired surface finish. It is not limited in its application to iron and steel products, but is in successful operation on a wide variety of non-ferrous metals, such as silver-lined bearings and chromium-plated cylinder bores.

Micromatic Hone Corporation builds machines for Microhoning as required in industrial production. These range from tool room type machines arranged to handle a wide variety of work to multiple spindle production machines which provide accuracy and high speed on production parts.

Microhoning can be very useful in your post-war production. Let our engineers discuss applications with you.

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MICROMATIC

MAKERS OF

New MICROMATIC HYDROHONER MODEL 705

MULTIPLE SPINDLES

AUTOMATIC ROTARY INDEXING

MICROSIZE CONTROL

MICRODIAL FEED CONTROL

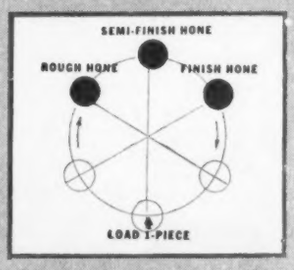
This new Micromatic Hydrohoner is a high speed production model, designed to produce large quantities of high precision parts. It may be used in multiple or progressive honing within uniform size limits (maximum) of .0003", on parts such as these:

Diesel Fuel Injectors, Pinion Gears, Precision Bearings, Bushings, Compressor Housing Bores, Piston Pin Holes, Connecting Rods, Valve Guides, Hydraulic Pump Bores, Rocker Arms, Ceramic Tubes, Valve Bodies.

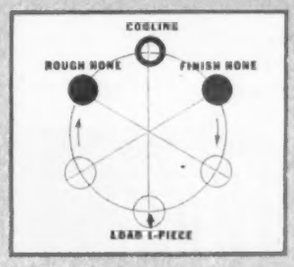
Variations in error which usually occur in production are corrected in straight run honing. Uniform size is automatically generated through the Micromatic Microsize Control—a positive, fully automatic method of generating uniform size.

Each spindle has its own individual Microsize Control, so that any desired combination in multiple or progressive honing may be set up.

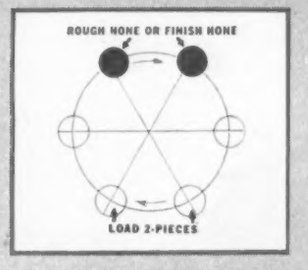
Three typical set ups are illustrated below:



THREE OPERATIONS. Progressive Honing Operations permit maximum stock removal per unit of time. Usually recommended for maximum stock removal ranging from .007 in ¼" diameter bores to .010 in 1" diameter bores.



TWO OPERATIONS. Progressive Honing Operations permit medium amount of stock removal per unit of time. Usually recommended for maximum stock removal ranging from .0035 in ¼" diameter bores to .005 in 1" diameter bores.



ONE OPERATION. Multiple Honing Operation permits conventional amount of stock removal per unit of time. Usually recommended for maximum stock removal ranging from .0005 to .0015 for hardened parts (55 Rock. C or harder), .001 to .003 for soft or medium hard parts, in bores from ¼" to 2" diameter.

HONE CORPORATION DETROIT 4, MICHIGAN

HONING MACHINE TOOLS

B. F. FAIRLESS,
President,
United States
Steel Corporation

"Raw Materials ... readily available"

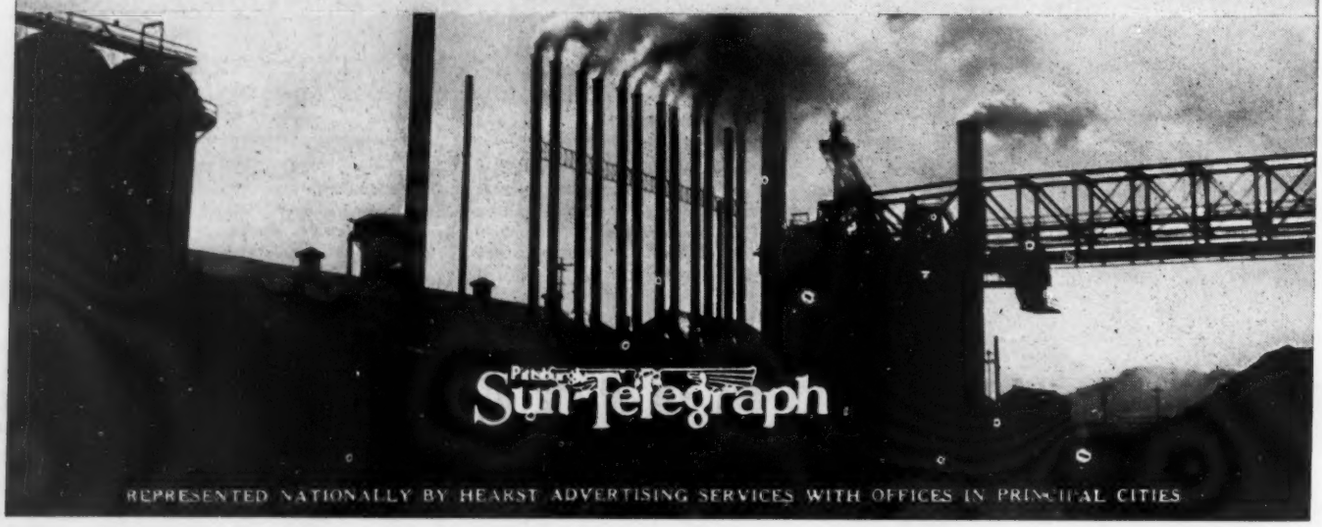
"Pittsburgh has prospered as a steel center because raw materials such as coal, limestone and iron ore for her mills are readily available and large steel consuming markets are near at hand. Nature gave the Pittsburgh area many advantages for unlimited industrial progress.

"Conversion of big strip mills such as Irvin Works helped U. S. Steel produce as much as one-third of the nation's plate need for ships and tanks. These and other mills can and will be quickly reconverted to help supply the enormous quantities of steel the world will need for peacetime rebuilding and prosperity.

"Pittsburgh has the opportunity to continue indefinitely as an important center of the steel industry."

B. F. Fairless

President,
UNITED STATES STEEL CORP.



REPRESENTED NATIONALLY BY HEARST ADVERTISING SERVICES WITH OFFICES IN PRINCIPAL CITIES

ESTABLISHED 1888

D.O.James

MAKERS OF

ALL TYPES OF GEARS AND GEAR REDUCERS

RACKS AND FLEXIBLE COUPLINGS

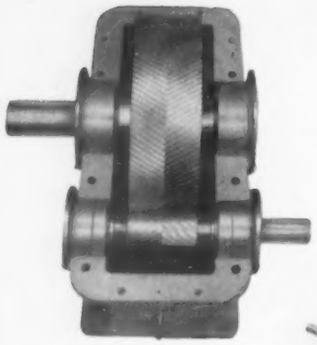
SALES AND ENGINEERING OFFICES ARE LOCATED IN THE FOLLOWING KEY CENTERS

Albany 7, N. Y., 82 State Street, Industrial Equipment Co.
Ansonia, Conn., 88 Main Street, L. Heres DeWyk & Co.
Atlanta, Ga., P. O. Box 9, Station E, Allied Companies
Birmingham 4, Ala., 701 Graymont Ave. N., S. L. Morrow Engrg. Co.
Boston, Mass., 80 Boylston Street, L. Heres DeWyk & Co.
Brooklyn 1, N. Y., The Cary Bldg., 120 Nassau St., W. E. Petty
Cincinnati, Ohio, 412 Traction Bldg., Chas. Upson
Cleveland 13, Ohio, 429 Rockefeller Bldg., S. M. Hird
Denver 2, Colo., 1863 Wazee St., Edwin P. Cook
Detroit, Michigan, 454 Book Bldg., H. F. Cates
Houston 2, Tex., 501 Citizens State Bk. Bldg., Industrial Sales & Engrg. Co.
Indianapolis 4, Ind., 314 E. N. Y. St., J. E. Aspinall
Lansing 8, Michigan, 506 Olds Tower Bldg., A. D. Schneider
Los Angeles 21, Calif., 1414 Santa Fe Av., J. V. MacDonald
Milwaukee 2, Wis., 828 Broadway, R. C. Phipps
Minneapolis 3, Minn., 1645 Hennepin Ave., Rex Raymond
New Orleans 12, La., 2207 American Bank Bldg., F. N. Johnston
Philadelphia, Pa., 629 Drexel Bldg., S. W. Merrill
Pittsburgh 22, Pa., 812B Investment Bldg., Donald C. Todd
Portland, Oregon, 112 S. W. First Ave., H. F. Bergis
Richmond 15, Va., 1434 East Main St., Industrial Supply Co.
Rochester, N. Y., 217 East Ave., Clifford H. Keller
St. Louis 14, Mo., 1411 N. Hanley Rd., F. E. Wheeler
San Francisco 7, Calif., 366 Brannan St., B. E. Sivyer
Seattle 4, Wash., 530 First Ave. So., W. Nichols
Syracuse 2, N. Y., 415 E. Jefferson St., George Rees
Tulsa, Okla., Tulsa Loan Bldg., Industrial Sales & Eng. Co.
Montreal, Quebec, Canada, 1006 Mountain St., Renold-Coventry

D. O. JAMES MANUFACTURING CO.

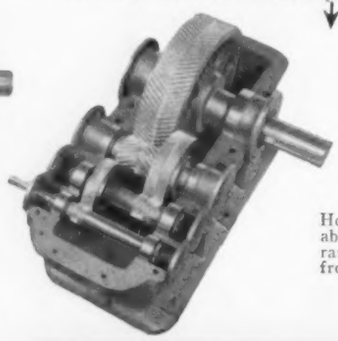
1140 W. MONROE STREET • CHICAGO, U. S. A.

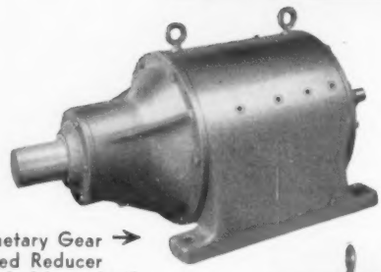
PLANETARY REDUCERS



Single Reduction Continuous-Tooth Herringbone Gear Reducer
Available in 14 sizes, in a ratio range of 2 to 10:1, and from 1 to 1230 horsepower.

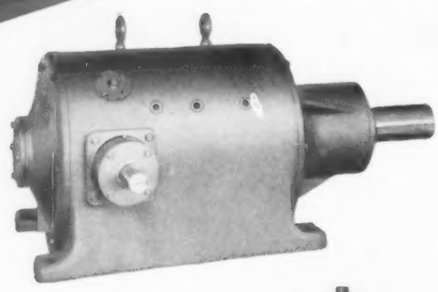
Double and Triple Reduction Continuous-Tooth Herringbone Gear Reducer
(Triple reduction illustrated below)
With offset shaft. Available in 24 sizes in a ratio range of 10 to 350:1 and from .63 to 380 h.p. ↓



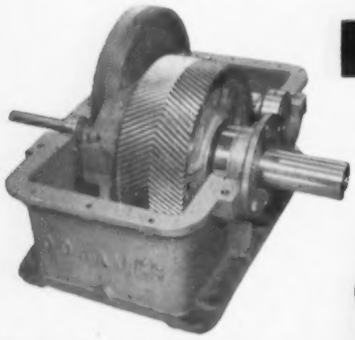


Planetary Gear → Speed Reducer
Horizontal drive. Available in 35 sizes in a ratio range of 10 to 1200:1 and from ¾ to 75 horsepower.

Right Angle Spiral Bevel Planetary Gear Speed Reducer
Horizontal drive. Available in 33 sizes in a ratio range of 8 to 1100:1 and from ½ to 75 horsepower. ↓



HERRINGBONE REDUCERS

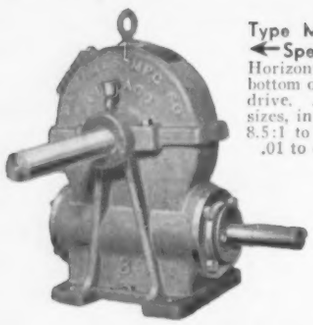


Double Reduction Continuous-Tooth Herringbone Gear Reducer
With straight-line drive. Available in 12 sizes in a ratio range of 10 to 75:1 and from 1 to 500 horsepower.

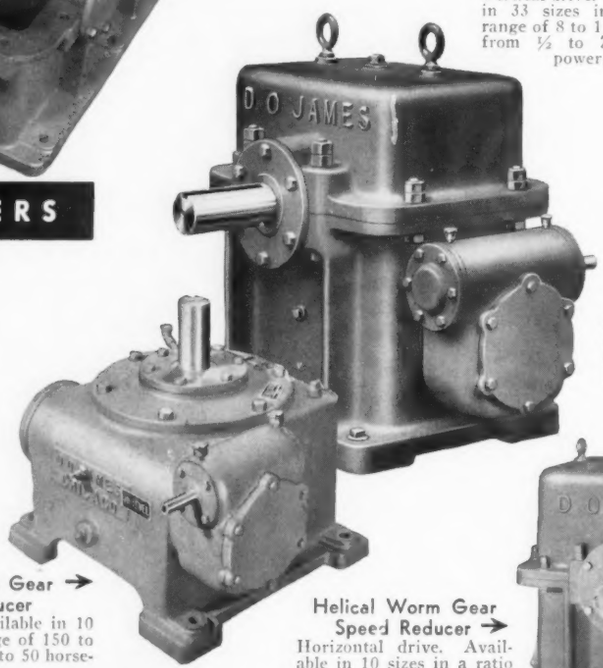
← Right Angle Spiral Bevel Herringbone Gear Reducer
Available in 11 sizes in a ratio range of 6 to 45:1 and from 1 to 250 horsepower. Horizontal and vertical drive. (Horizontal drive illustrated.)

Right Angle → Spiral Bevel Planetary Gear Speed Reducer
Vertical drive. Available in 33 sizes in a ratio range of 8 to 1100:1 and from ½ to 75 horsepower.

WORM GEAR REDUCERS



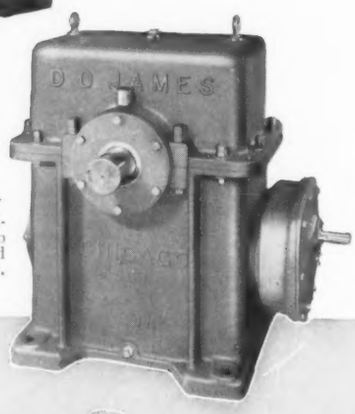
Type M Worm Gear ← Speed Reducer
Horizontal drive, worm bottom or top, or vertical drive. Available in 48 sizes, in a ratio range of 8.5:1 to 240:1 and from .01 to 42 horsepower.

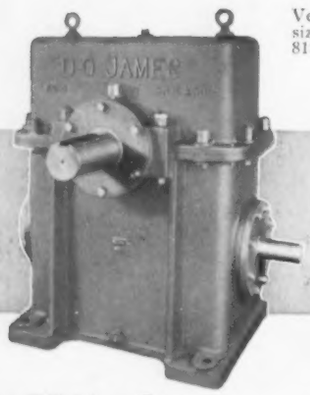


Double Worm Gear ← Speed Reducer
Horizontal drive. Available in 10 sizes in a ratio range of 150 to 8100:1 and from ⅛ to 50 horsepower.

Double Worm Gear → Speed Reducer
Vertical drive. Available in 10 sizes in a ratio range of 150 to 8100:1 and from ⅛ to 50 horsepower.

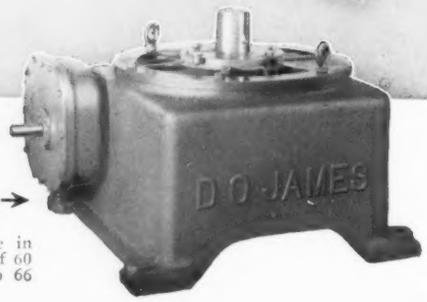
Helical Worm Gear Speed Reducer →
Horizontal drive. Available in 10 sizes in a ratio range of 60 to 240:1 and from ¼ to 66 horsepower.





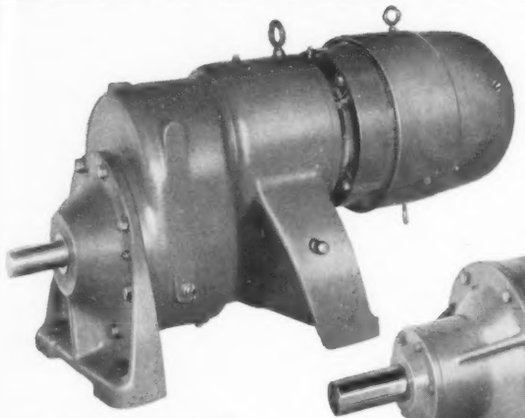
Type "H" Worm Gear Speed Reducer
Horizontal drive. Worm bottom or top. Available in 26 sizes in a ratio range of 6 to 65:1 and from 1/32 to 150 horsepower.

Type "H" Worm ↑ Gear Speed Reducer
Vertical drive. Available in 13 sizes in a ratio range of 6 to 65:1 and from 1/32 to 150 horsepower.

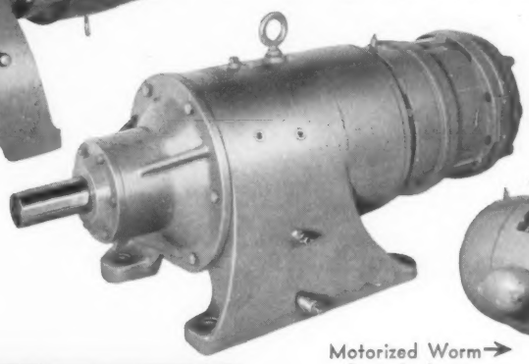


Helical Worm Gear → Speed Reducer
Vertical drive. Available in 10 sizes in a ratio range of 60 to 240:1 and from ¼ to 66 horsepower.

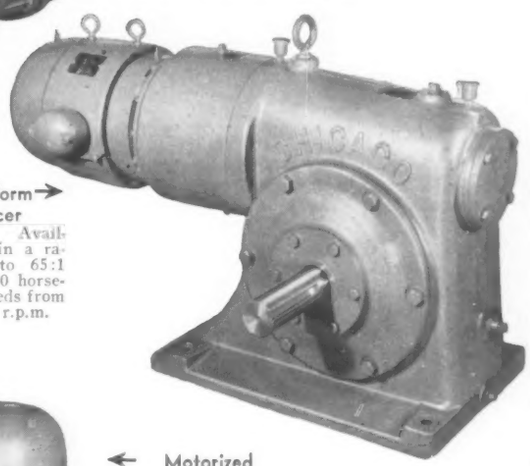
Your power saving requirements are capably handled by an organization making every type of gear reducer.



Motorized Helical Reducer
Horizontal drive. Available in 8 sizes in a ratio range of 1¼ to 9:1 and from ¾ to 50 horsepower. Driven speeds from 1458 r.p.m. to 128 r.p.m.



← **Motorized Planetary Reducer**
Horizontal drive. Available in 35 sizes in a ratio range of 10 to 1200:1 and from ¾ to 75 horsepower. Driven speeds from 172 r.p.m. to .74 r.p.m.



MOTORIZED REDUCERS

Motorized Worm → Gear Reducer
Horizontal drive. Available in 11 sizes in a ratio range of 6 to 65:1 and from ⅛ to 30 horsepower. Driven speeds from 310 r.p.m. to 25 r.p.m.

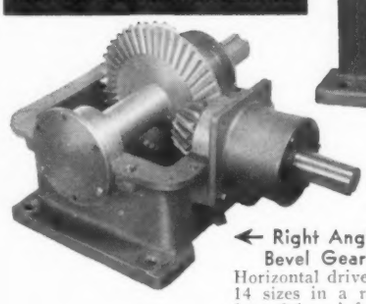
Motorized Worm ← Gear Reducer
Vertical drive. Available in 11 sizes in a ratio range of 6 to 65:1 and from ⅛ to 30 horsepower. Driven speeds from 310 r.p.m. to 25 r.p.m.

Right Angle Spiral Bevel ← Gear Reducer
Vertical drive. Available in 14 sizes in a ratio range of 1:1 to 6:1 and from .3 to 275 horsepower.

← **Motorized Planetary Reducer**
Vertical drive. Available in 35 sizes in a ratio range of 10 to 1200:1 and from ¾ to 75 horsepower. Driven speeds 172 r.p.m. to .74 r.p.m.

Motorized → Helical Reducer
Vertical drive. Available in 8 sizes in a ratio range of 1¼ to 9:1 and from ¾ to 50 horsepower. Driven speeds 1458 r.p.m. to 128 r.p.m.

BEVEL GEAR REDUCERS



← **Right Angle Spiral Bevel Gear Reducer**
Horizontal drive. Available in 14 sizes in a ratio range of 1 to 6:1 and from .3 to 275 horsepower.

Send for Complete Catalog

D. O. James

MANUFACTURING COMPANY

1140 W. MONROE ST.; CHICAGO, U. S. A.

ESTABLISHED 1888

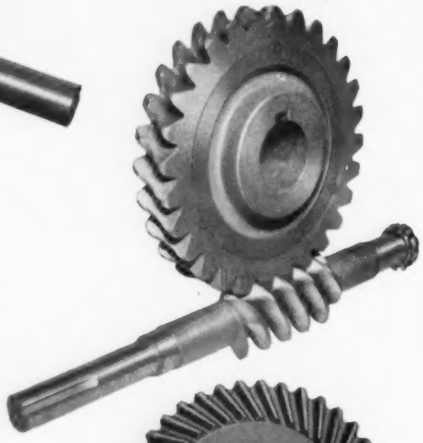
MAKERS OF EVERY TYPE OF GEAR AND GEAR REDUCER

D. O. JAMES GEARS

are the product of an organization with over 55 years of gear making experience. Our extensive and unexcelled gear cutting facilities enable us to capably handle modern industry's gear requirements.

← **Continuous-Tooth Herringbone Gears**
The Sykes generator continuous-tooth produces a gear with a backbone that has many advantages. Gears from 1" to 60" in diameter, 16 DP to 1½ DP and up to an 18" face.

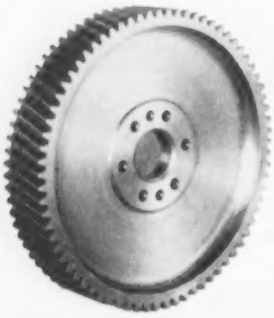
D. O. James Worm Gears
Gear teeth are generated on tangential feed hobbing machines by tapered and ground hobs. We make worm gears from 1" to 100" in diameter and from 24 DP to 1 DP. ↓

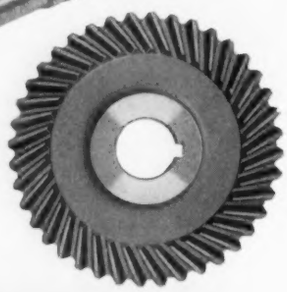


Spur Gears
Precision made standard pitch gears. In a very extensive range from ¾ inch to 150 inches in diameter and 32 DP to ¾ DP and up to 24-inch face. ↓

Bevel Gears
(Straight tooth) made from 1 inch to 60 inch in diameter and from 24 DP to ¾ DP. Precision made and of highest quality.

Helical Gears
Made from 1 to 60 inches in diameter and from 24 DP to 1½ DP. Our helical gear cutting department ↓ is capable and extensive.



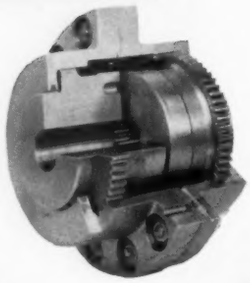


← **Spiral Bevel Gears**
Cut in a size range from 1 to 27 inches in diameter. 24 DP to 1½ DP.

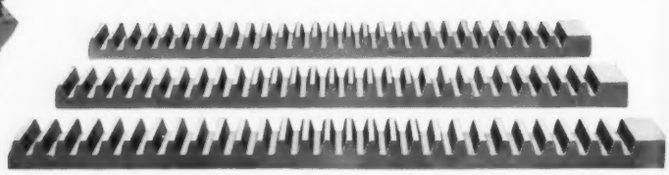
FLEXIBLE COUPLINGS

← **The D. O. James Flexible Coupling**
Manufactured in a size range that will meet industrial requirements. See our coupling bulletin for sizes, engineering data and prices.

Type D E Gearflex Coupling →
Dependable, efficient and economical and made in various sizes. Refer to coupling bulletin.



← **Universal Couplings**
Manufactured in various sizes. Refer to coupling bulletin.



RACKS

Racks
Cut in any length with teeth of 24 DP to 1 DP.

D.O.James

Makers of every type of gear and gear reducer

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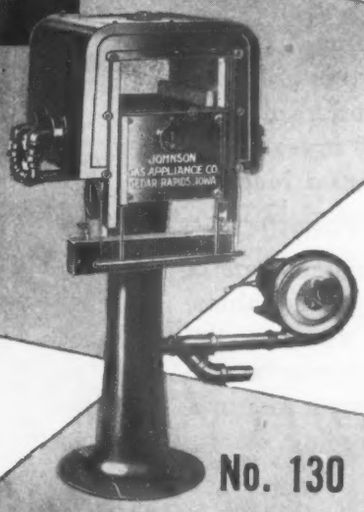
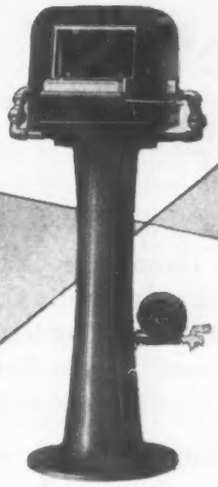
Jump to Johnson Furnaces for QUICK Action



No. 130



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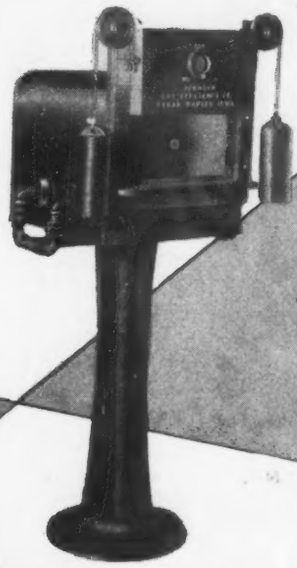
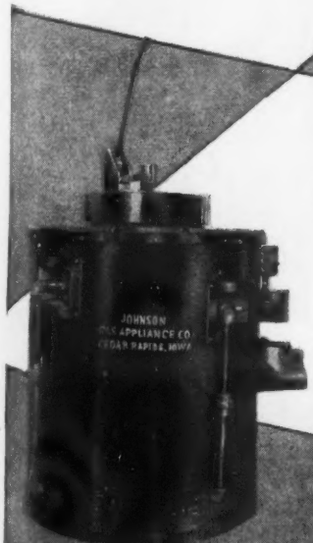


No. 130-A



No. 575

No. 70

Johnson Furnaces reach operating Temperatures FAST to break all records for speed in clean heat-treating operations!

No. 120	Hi-Speed Steel Heat-Treating Furnace	$129.50
No. 130	Hi-Speed Steel Heat-Treating Furnace	$248.00
No. 130A	Hi-Speed Steel Heat-Treating Furnace	
	4 Burner — 1400-2000° F.	$295.00
	6 Burner — 1800-2400° F.	$325.00
No. 575	Pot Hardening and Melting Furnace	$400.00
No. 70	Hi-Speed Steel Bench Furnace	$ 89.50

All furnaces shown equipped complete with G. E. Motor and Johnson Blower.

ALL PRICES F.O.B. FACTORY

Free USE COUPON FOR CATALOG

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573 E. Ave. N.W., Cedar Rapids, Iowa
Please send me Free Johnson Catalog.

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CITY ..... STATE .....

Hanna Air and Hydraulic Cylinders

an asset to...

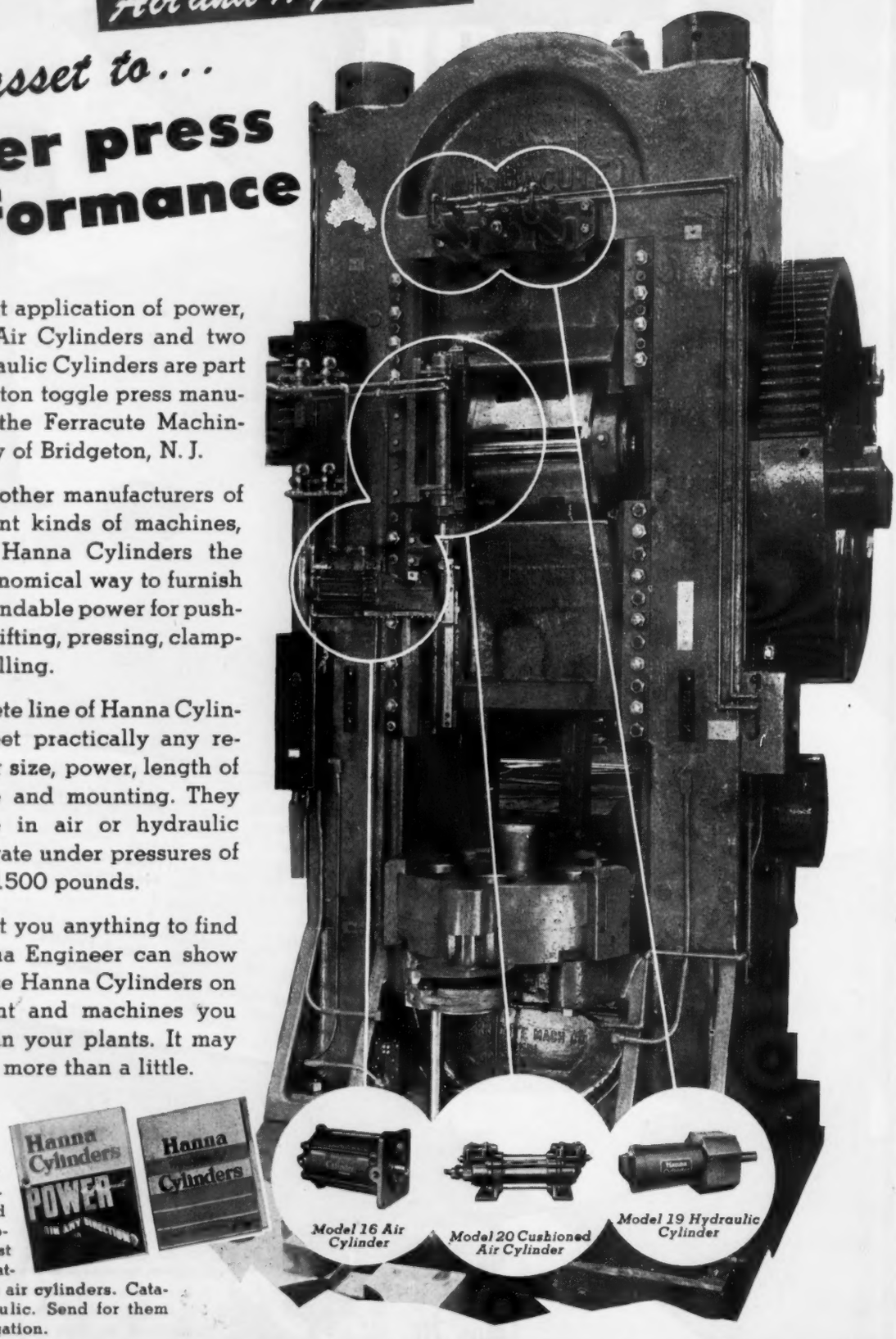
better press performance

FOR efficient application of power, two Hanna Air Cylinders and two Hanna Hydraulic Cylinders are part of this 2500 ton toggle press manufactured by the Ferracute Machinery Company of Bridgeton, N. J.

They, like other manufacturers of many different kinds of machines, have found Hanna Cylinders the efficient, economical way to furnish smooth, dependable power for pushing, pulling, lifting, pressing, clamping or controlling.

The complete line of Hanna Cylinders will meet practically any requirement for size, power, length of piston stroke and mounting. They are available in air or hydraulic types, to operate under pressures of from 100 to 1500 pounds.

It won't cost you anything to find out if a Hanna Engineer can show you how to use Hanna Cylinders on the equipment and machines you build or use in your plants. It may profit you . . . more than a little.



These catalogs give complete specifications, details and data to help you select the cylinder best suited to your job. Catalog No. 230 covers air cylinders. Catalog No. 233, hydraulic. Send for them today, without obligation.

HANNA ENGINEERING WORKS
1765 ELSTON AVENUE • CHICAGO 22, ILLINOIS

Air and Hydraulic RIVETERS VALVES

Air and Hydraulic CYLINDERS AIR HOISTS

KEEP YOUR KNOWLEDGE OF CARBON AND ALLOY STEELS UP-TO-THE-MINUTE!

Write for These Two NEW Lebanon Reference Charts

WITH big production changes ahead, knowledge of materials must be up-to-the-minute. That's why Lebanon Steel Foundry now issues revised editions of its widely circulated charts on Lebanon Circle (L) Stainless, Corrosion and Heat Resistant Alloys and on Lebanon Circle (L) Carbon and Low Alloys.

First issued three years ago, these charts have been popular among steel castings users because they provide helpful information in handy form. They're file-size . . . and so designed that information is available at a glance without thumbing pages. Both charts show comparable specification designations (including wrought and cast materials), analyses, physical properties and heat treatment.

Executives, engineers and metallurgists may obtain copies of these concise, up-to-the-minute reference charts, without charge, by writing to Lebanon Steel Foundry.

LEBANON STEEL FOUNDRY **LEBANON, PA.**

ORIGINAL AMERICAN LICENSEE GEORGE FISCHER (SWISS CHAMOTTE) METHOD

Eight-Way DRILLING and TAPPING MACHINE *by Snyder*

This large special-purpose machine, designed and built by Snyder, demonstrates the practicality of combining multiple drilling and multiple tapping in a production operation.

The part is clamped in a locating fixture mounted on a 180° index table which, in turn, is mounted upon a ball bearing fixture carriage.

The carriage carries the part, first, to the left end of the machine for the drilling operation, then (after indexing 180°) to the right for the tapping operation.

The multiple drilling heads and bushing plates are mounted on Snyder self-contained hydraulic guide bar units.

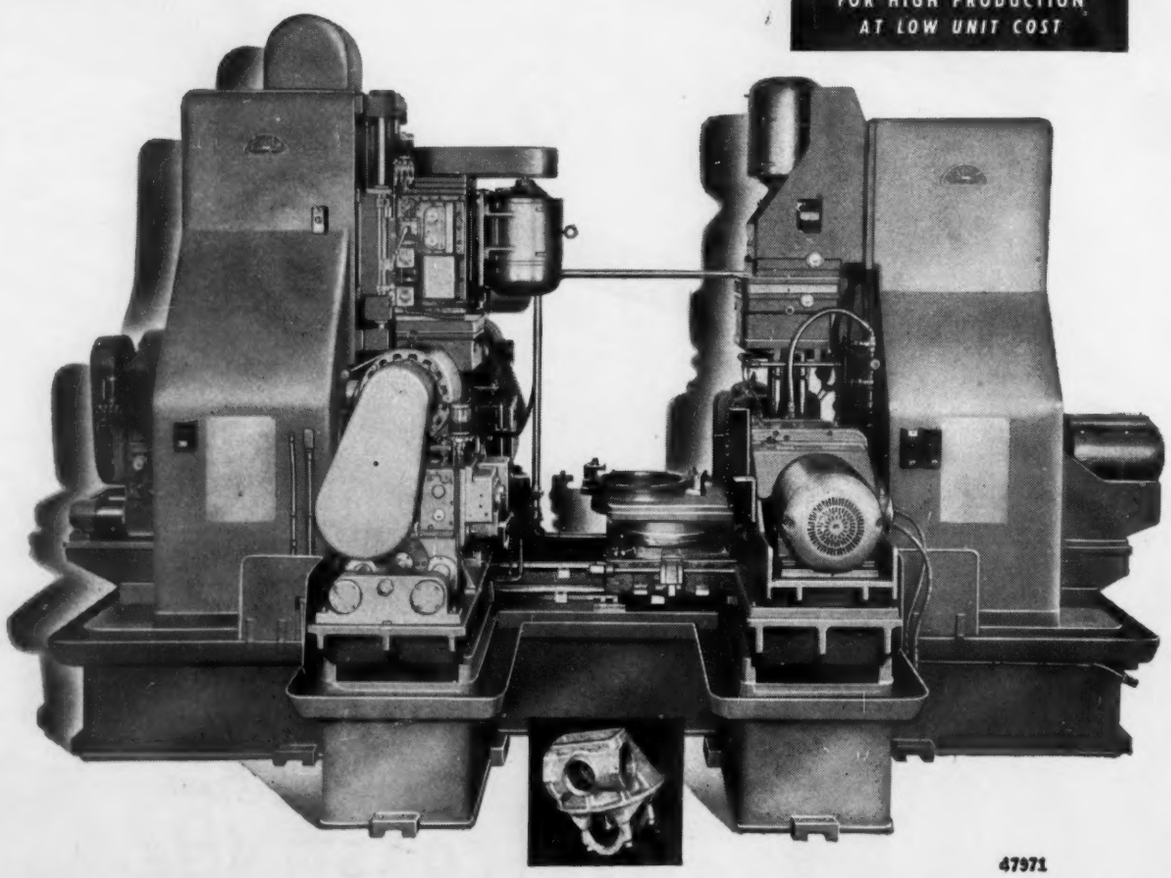
Tapping units are equipped with fixed center tapping heads. Each spindle has individual screw feed and is equipped with ball bearing safety spindle end to protect work piece and tools, providing automatic retraction of any individual tool which encounters any obstacle. All heads interchangeable for a wide variety of other parts.

With the safeguards and controls which Snyder has provided, this type of machine is adaptable to a considerable range of parts and may be retooled again and again, at relatively little cost, since only the equipment is changed.

If your postwar plans call for the efficiency and economy of special-purpose production machines, we invite your inquiry—*Snyder Tool & Engineering Company, 3400 E. Lafayette, Detroit 7, Michigan.*

20 Years of Successful Co-operation with Leading American Industries

SNYDER
DESIGNERS AND BUILDERS OF SPECIAL-PURPOSE MACHINES FOR HIGH PRODUCTION AT LOW UNIT COST



When You Order Your Favorite Brand of HACK SAW BLADES Specify this—

"made from INGERSOLL D-B-L STEEL"

"Lucky for us that Hack Saw Blade makers can get Ingersoll D-B-L Steel"

5 YEARS EXPERIENCE

in the Production of this Lower Cost Type of

HIGH SPEED STEEL *for* HACK SAW BLADES

★ ★ ★ ★ ★

Specify Ingersoll D-B-L Steel for your Hack Saw Blades on its 5-year Record of Past Performance.

INGERSOLL D-B-L

(Tungsten . . . . . 5.00-6.00)
(Molybdenum . . 4.00-5.00)

The remarkable performance of Ingersoll D-B-L . . . its relative freedom from decarburization . . . its tough cutting quality and its high impact resistance . . . plus its lower cost, have made it a wartime favorite.

"A Borg-Warner Product"

INGERSOLL STEEL & DISC DIVISION
BORG-WARNER CORPORATION
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Plants: New Castle, Ind.; Chicago, Ill.; Kalamazoo, Mich.

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Stainless Steels and Saw Steels, including "18-4-1" and Molybdenum and D-B-L Hack Saw Steels

Fifty-five years of

EXPERIENCE AND RESEARCH

at your service

PENINSULAR has been building grinding wheels for 55 years—and never once in all those years has our original purpose changed. Today, as always, Peninsular builds only one kind of grinding wheel—the *finest* it is possible to produce, the *most efficient* for the job at hand.

To accomplish this has taken endless time and a considerable outlay of money in research and equipment. But the results that have come from this pioneering have well been worth the effort.

Records of the grinding wheel industry show that many of the basic advancements in grinding wheel methods—the fabrication of abrasive wheels, and the machinery for their manufacture—have come from Peninsular.

As we approach the period of reconversion, you may expect from Peninsular continued improvements to meet industry's new peacetime problems.

A STANDING INVITATION

Our expert staff of factory and field engineers are ready today to help in your postwar preparation—with a production, engineering and cost analysis service beyond any offered up to now in the industry.

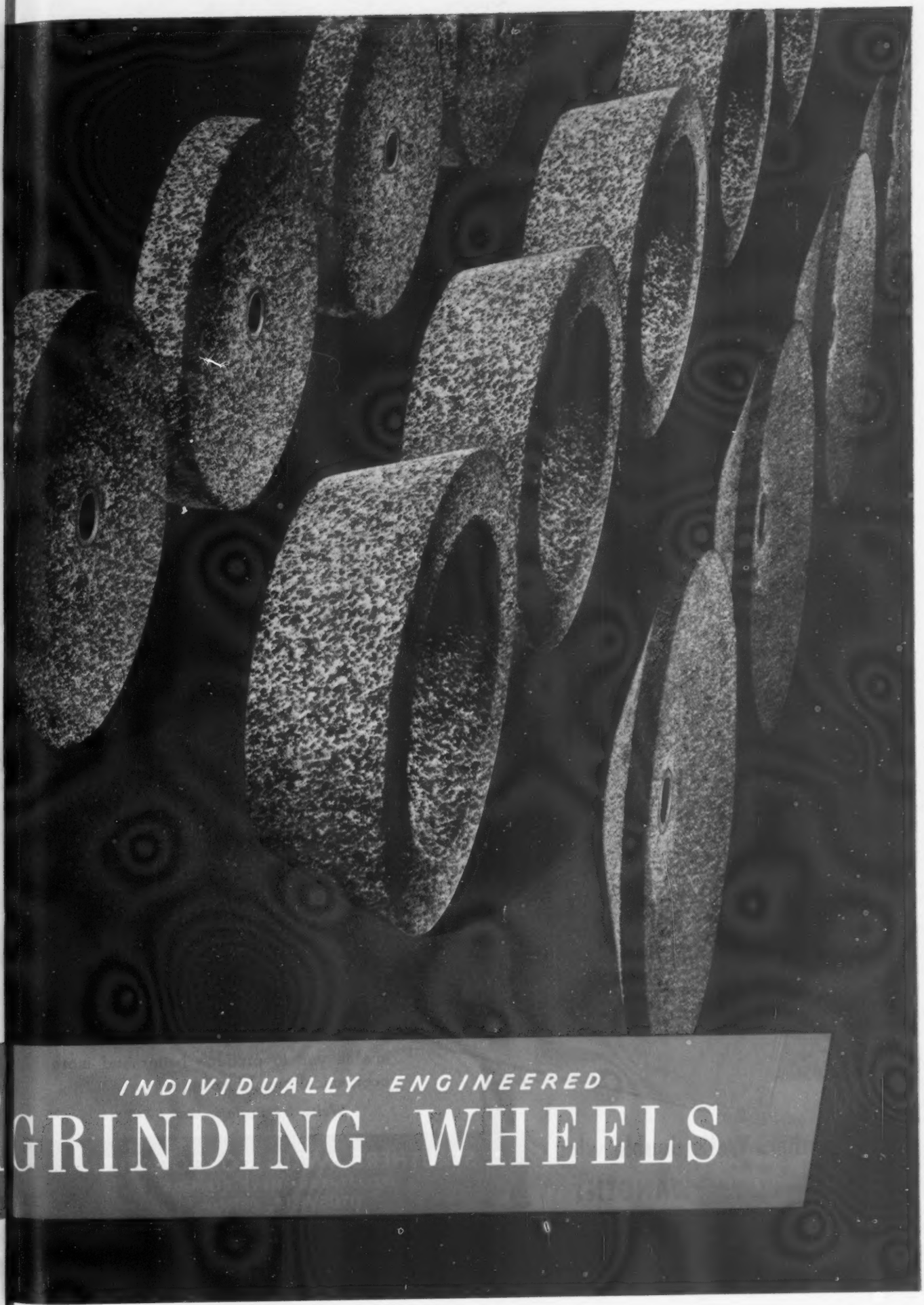
The Peninsular Grinding Wheel Company, 729 Meldrum Ave., Detroit 7, Michigan. *Branch Offices:* Chicago, Cleveland, Newark, Pittsburgh.

SPECIALISTS IN RESINOID BONDED WHEELS

PENINSULAR GR

SINCE 1889

Illustration shows Peninsular straight, tapered cup and dish wheels for portable grinders.

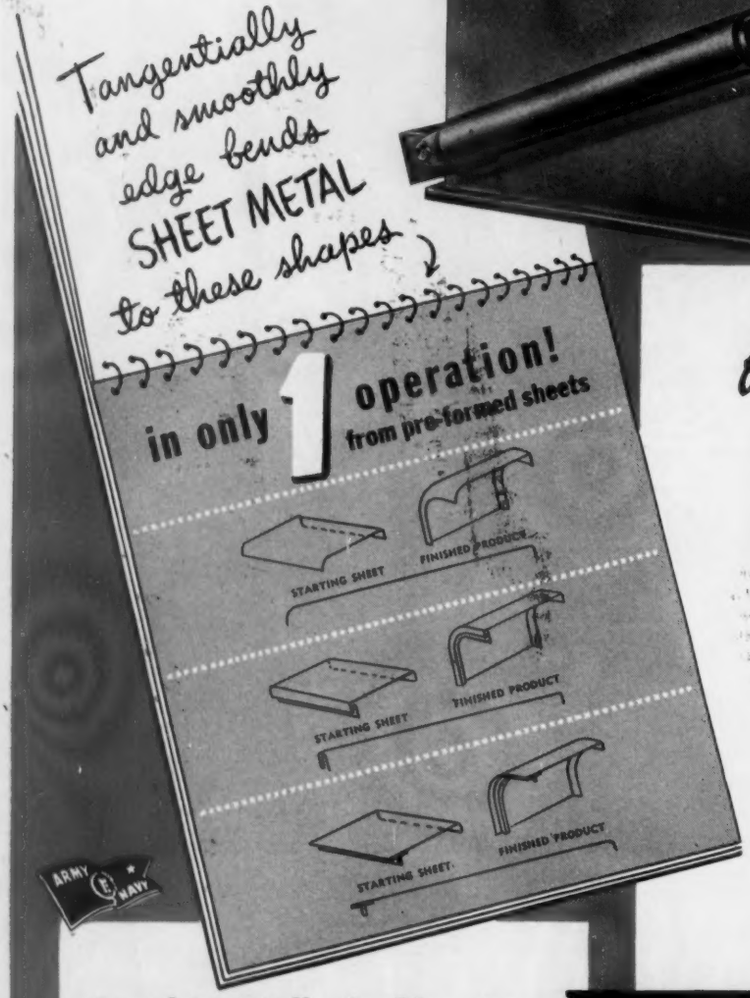

INDIVIDUALLY ENGINEERED
GRINDING WHEELS

Struthers Wells introduces the . . .

SW New SINGLE WING Tangent Bender

U. S. Patent
No. 2,287,933
Other Patents Pending

Tangentially and smoothly edge bends SHEET METAL to these shapes



for fast, economical PRODUCTION

Struthers Wells Single Wing Tangent Bender has been designed for applications requiring more frequent die changes and shorter runs. It provides tangent bending to *precision-tolerance*, greatly increased production on difficult operations—with fewer expensive man-hours. This hydraulically operated machine is also an improved brake. *Tangent bending* should enable you to produce better and more economical metal furnishings . . .

Write for Bulletin No. 57-T

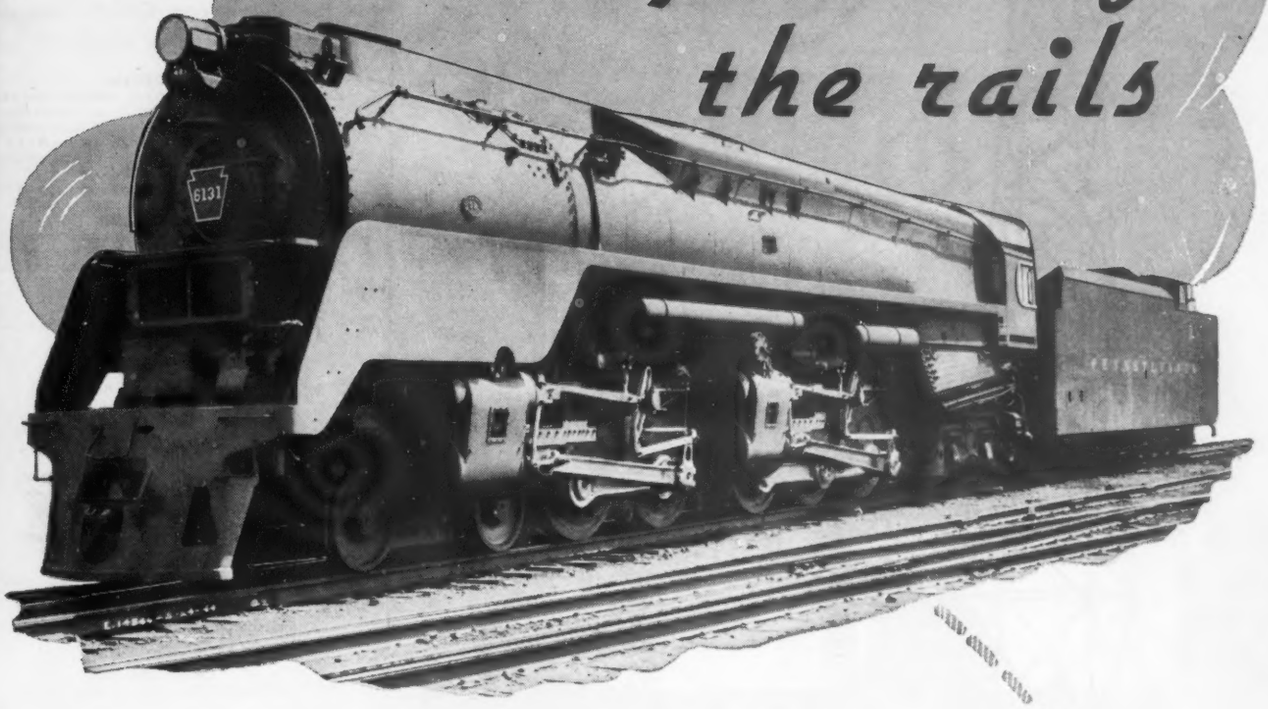
Struthers Wells double wing

A heavy duty hydraulic machine for greater production. Fully described in Bulletin No. 53-T.

TANGENT BENDER

STRUTHERS WELLS CORPORATION
SPECIAL EQUIPMENT DIVISION
TITUSVILLE, PENNA.
Plants at Titusville and Warren, Pa.—Offices from Coast to Coast

PENNSYLVANIA'S *New Giants of the rails*



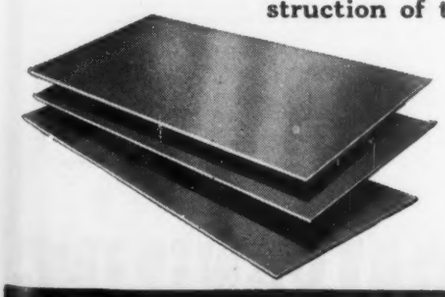
. . . use

WORTH STEEL PLATE

Above is shown "the first," in a fleet of 26 new powerful locomotives being built by the Pennsylvania Railroad Company's Altoona, Pa., Shops. This giant is designed to pull a 125-car train at more than 50 m. p. h. Its weight with tender, 40 tons of coal, and 19,000 gallons of water is 1,053,000 lbs.

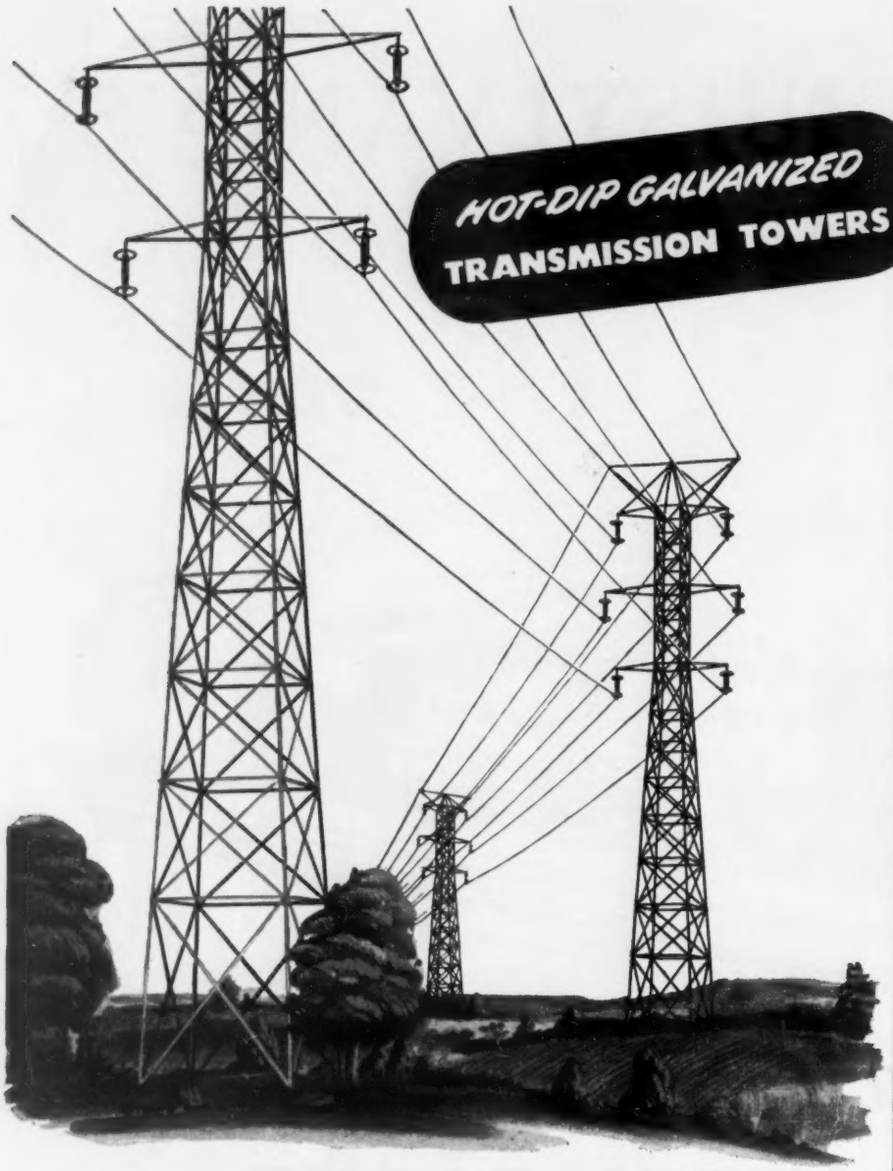
We of Worth are very proud to have participated in furnishing steel plates used in the construction of these locomotives.

ARMY E NAVY



WORTH

WORTH STEEL COMPANY · Claymont, Delaware



WILL IT RUST?

WHERE costly installations are exposed to the elements and rust prevention is of first importance—Hot-Dip Galvanizing proves its own case. Day in and day out it pays its own way in longer, uninterrupted service and savings from replacement and maintenance costs.

Zinc, when applied by the Hot-Dip Galvanizing method, provides the best possible coating obtainable. Laboratory and field tests have proved it the most dependable rust preventive.

For information as to how zinc protective coatings will lengthen the life of your product write to any member of this association or to The American Hot-Dip Galvanizers Ass'n. Inc., First National Bank Building, Pittsburgh 22, Pa.

"If it carries this seal it's a job well done."

Buy from the qualified members listed below and KNOW you are getting a genuine HOT-DIP job.

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JOSLYN CO. OF CALIFORNIA, LOS ANGELES
WESTERN GALVANIZING COMPANY, LOS ANGELES
HUBBARD & CO., OAKLAND
JOHN FINN METAL WORKS, SAN FRANCISCO
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"It Costs Less to Own and to Operate Victor"

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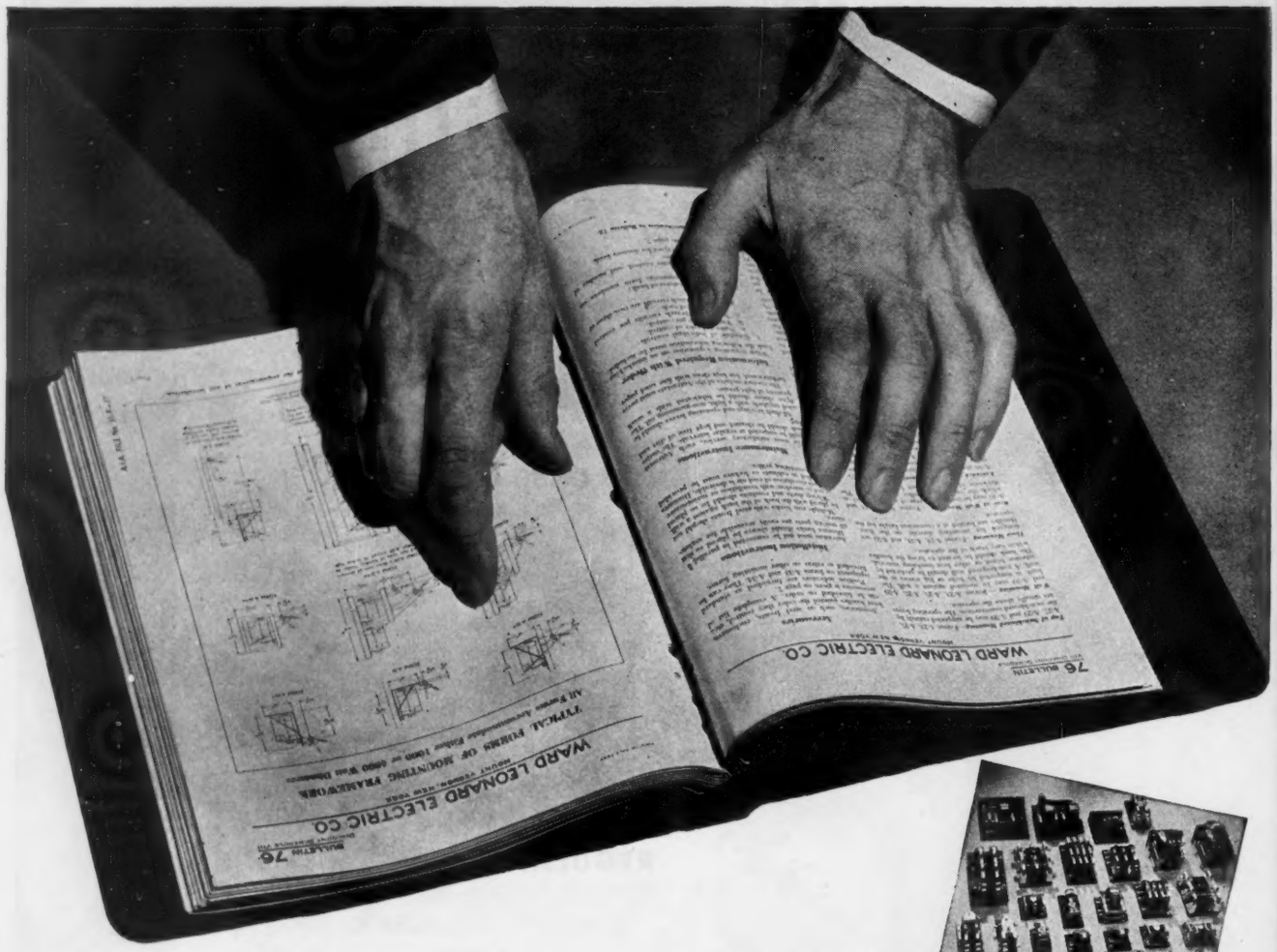
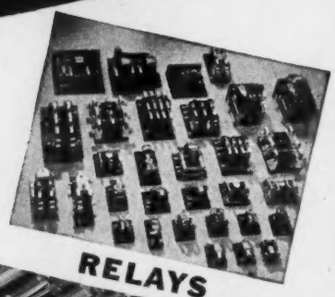
Distributing Points From Coast To Coast

NO LOST TIME FOR *Reconversion*





RELAYS

RESISTORS

RHEOSTATS

These Controls Are Ready

Practically every Ward Leonard Product used for war purposes required little or no equipment change. The controls of the machines of peace are essentially the same controls of machines of war. Hence, when the entire facilities of Ward Leonard were needed for the war emergency, production went on as usual, only in greater magnitude. Those same facilities are available for postwar production as and when they are released from war service. Again the change-over will be made without delay as there is no need for reconversion. The products are the same except for specifications and will be made by the same workers and same machines. When planning the controls for your postwar products, you will save time and money and be assured of war-tested units, controls and assemblies by making your selection from the Ward Leonard line. Send for bulletins describing controls of interest to you.

WARD LEONARD

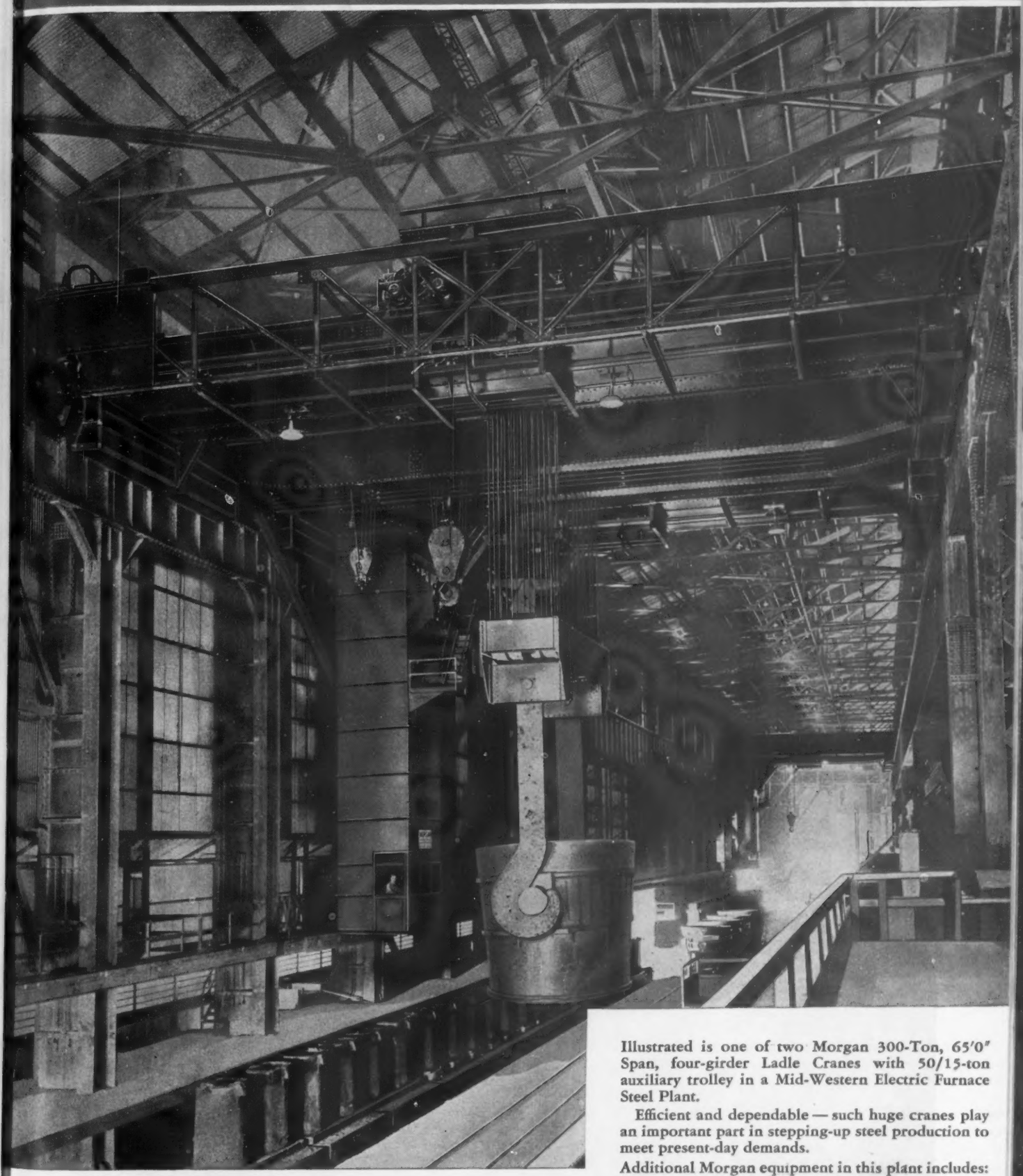
ARMY E NAVY

RELAYS • RESISTORS • RHEOSTATS

Electric control (WL) *devices since 1892.*

WARD LEONARD ELECTRIC COMPANY · 65 SOUTH ST. · MOUNT VERNON, N. Y.

BUILT BY MORGAN *Engineering*



Illustrated is one of two Morgan 300-Ton, 65′0″ Span, four-girder Ladle Cranes with 50/15-ton auxiliary trolley in a Mid-Western Electric Furnace Steel Plant.

Efficient and dependable — such huge cranes play an important part in stepping-up steel production to meet present-day demands.

Additional Morgan equipment in this plant includes:
Three 150-Ton, 65′0″ Span Pouring Cranes.
Two 150-Ton, 80′3″ Span Hot Metal Charging Cranes.
Two 200-Ton, 63′0″ Span Universal Type Ingot Strippers.

MORGAN 300-TON, 65′0″ SPAN POURING CRANE

THE MORGAN ENGINEERING CO.
ALLIANCE, OHIO. 1420 Oliver Building, Pittsburgh

DESIGNERS • MANUFACTURERS • CONTRACTORS • BLOOMING MILLS • PLATE MILLS • STRUCTURAL MILLS • ELECTRIC TRAVELING CRANES • CHARGING MACHINES • INGOT STRIPPING MACHINES SOAKING PIT CRANES • ELECTRIC WELDED FABRICATION • LADLE CRANES • STEAM HAMMERS • STEAM HYDRAULIC FORGING PRESSES SPECIAL MACHINERY FOR STEEL MILLS

ONE OF *America's Biggest*

is 100%

ON HOT AND COLD MILL

Wherever there's a bearing on hot and cold mill work and back-up roll necks and on drives, cranes, tables, coilers, etc., of this huge installation, there's an SKF Spherical Roller Bearing.

That's where rolling alignment eliminates bearing binding while compensating for shaft deflections, distortions or weave—where high bearing capacity and low friction are ever-present . . . where tonnage goes up and *stays UP.*

Another good illustration of the big swing to SKF's for the machines that make materials for other machines. 5719

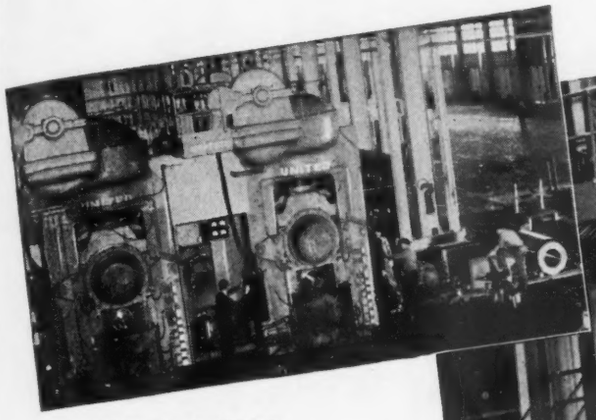
SKF INDUSTRIES, INC., PHILA. 34, PA.

t Duralumin Mills

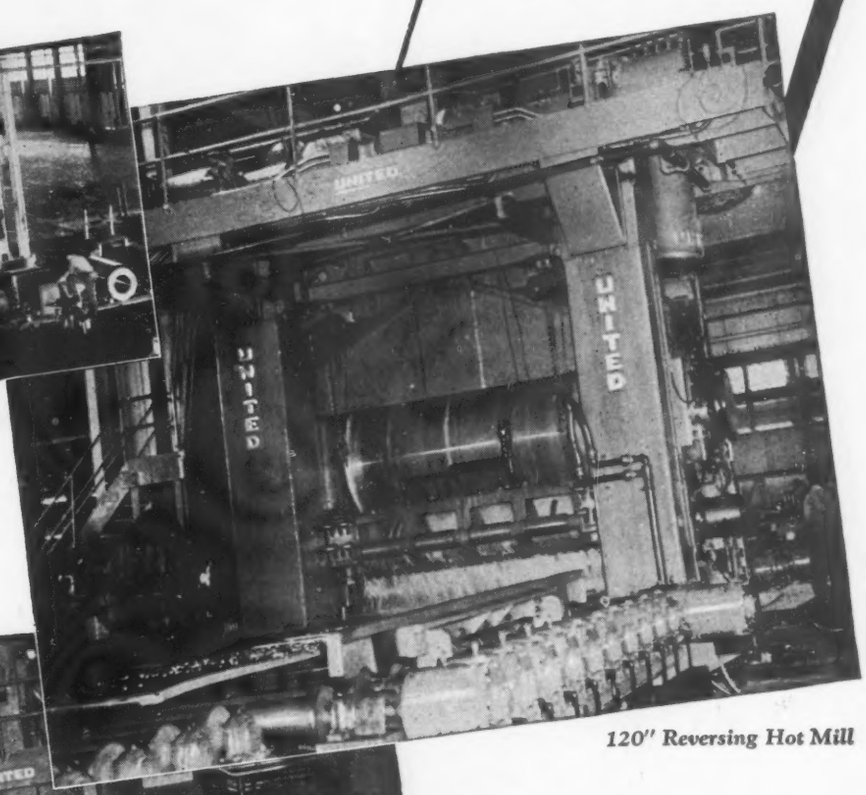
% SKF-equipped

LL WORK AND BACK-UP ROLL NECKS

BUILT BY
UNITED
ENG'G & F'DRY CO.



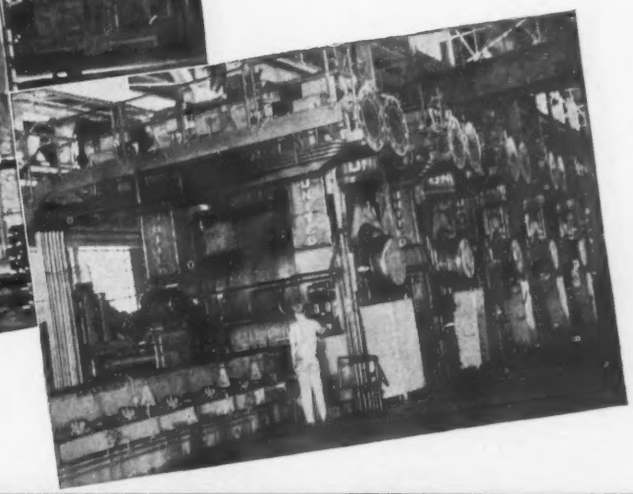
2-66" Single Cold Mill Stands

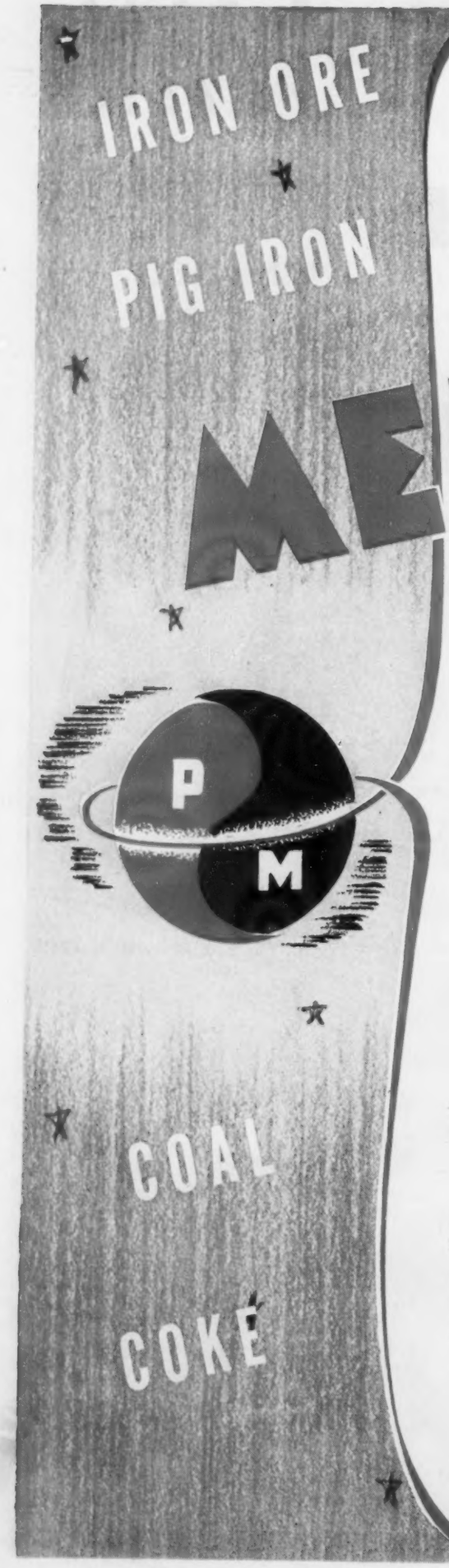


120" Reversing Hot Mill

112" Reversing Hot Mill

80" Five-Stand Tandem Hot Mill





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Get Faster, Smoother, More Accurate

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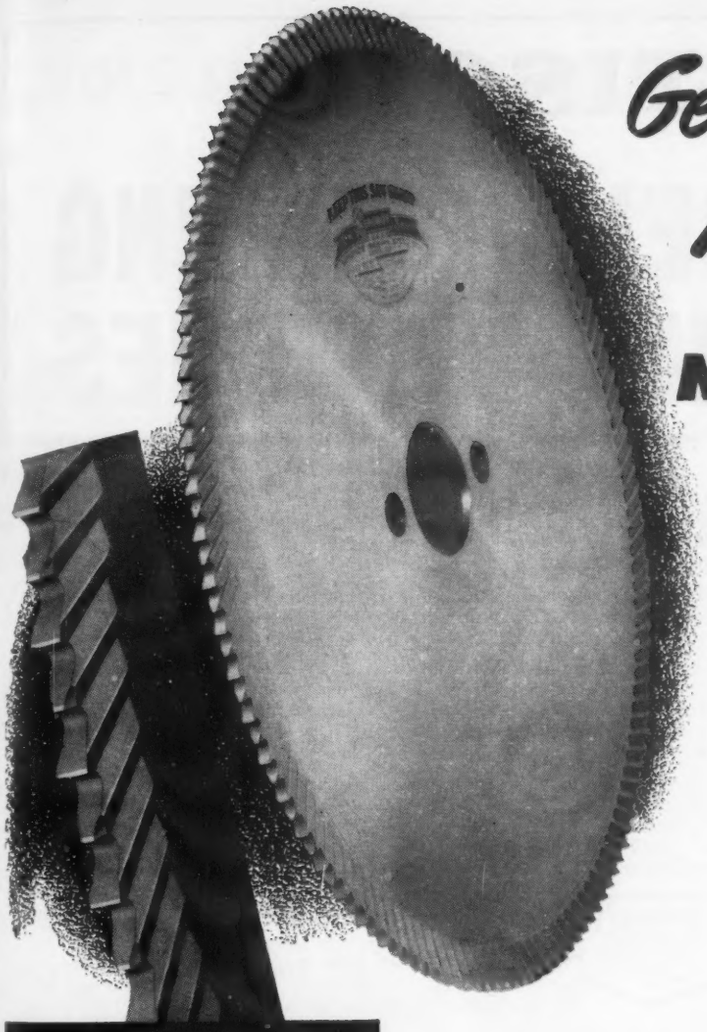

⇦ with SIMONDS Segmental Saws for Fine Pitch and Extra-Smooth Cut

These saws cut straight and true under highest pressure, without vibration or chatter. Saw plate is specially heat-treated so as to be practically unbreakable. And the high-speed cutting segments are tongued into the groove in the plate, then held in place by 5 rivets each. This construction gives highest tensile and torsional strength . . . gives *you* extra cutting life . . . and enables you to make ready replacement of the interchangeable cutting segments.

Simonds Segmental Saws combine the best features of all similar types of fine-tooth saws . . . plus the exclusive feature of a special Simonds high-speed steel, specially heat-treated to withstand the overloading commonly encountered on high-production cutting jobs.

⇦ with SIMONDS Inserted-Tooth Saws For Heavy Cuts

These circular saws have curved gullets and high-speed steel teeth . . . with a wedge for every tooth . . . to provide greater cutting speed, feed, and depth of cut. Production is nearly double that of solid-tooth saws. Inserted teeth can be sharpened in the plate, or can be replaced when necessary by a mechanic right in your own plant.

Order Simonds Segmental and Inserted-Tooth Circular Saws from your dealer, or from the nearest Simonds office listed.

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PRODUCTION TOOLS FOR CUTTING METAL, WOOD, PAPER, PLASTICS

SIMONDS SAW AND STEEL CO.

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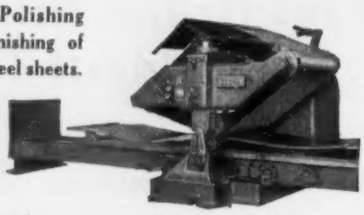
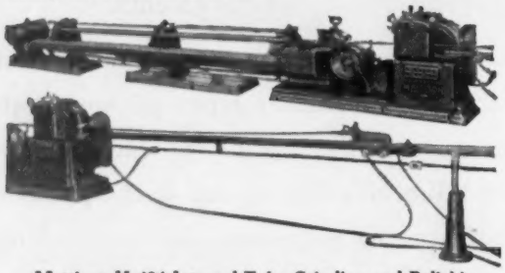
MATTISON
ABRASIVE BELT GRINDING AND POLISHING MACHINES

Mattison W-455 Wide Belt Grinding and Polishing Machine for finishing of wide stainless steel sheets.

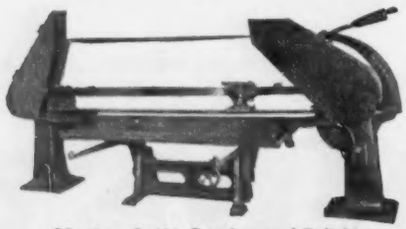


Mattison S-441 Grinding and Polishing Machine for flat and curved work. Can be furnished with or without special fixtures, depending on work ground. →

Mattison J-400 Backstand Idler adapts regular polishing Jack to the use of factory-coated abrasive belts.



Mattison H-424 Internal Tube Grinding and Polishing Machine for finishing inside of metal tubes.



Mattison L-138 Grinding and Polishing Machine arranged for wet grinding.

★ Results obtained in a number of plants definitely establish the use of factory coated abrasive belts as a most efficient practice. Besides reducing the number of rejections and improving the finish, they have cut the polishing cost per piece through increased production.

However, to secure full benefit from factory-coated abrasive belts, the right type of mechanical unit is necessary. The machine is all important for properly applying the abrasive to the particular job to be done.

Mattison Abrasive Belt Grinding and Polishing Machines are engineered with a knowledge of the factors involved to give the best application of belts. From the time factory-coated abrasive belts were introduced for metal grinding and polishing, Mattison's have developed and built machines to provide best results.

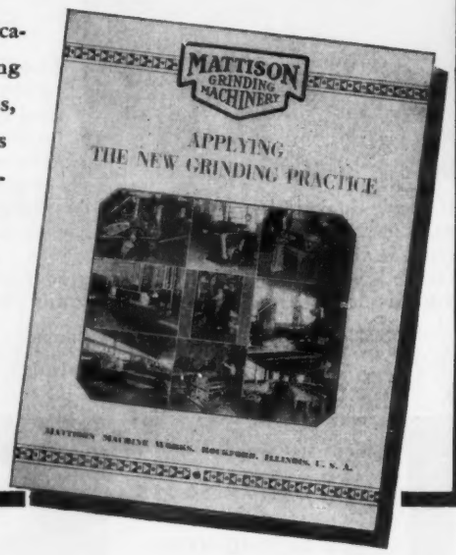
Mattison Abrasive Belt Grinding and Polishing Machines are used for smoothing up welding marks, polishing solid parts—such as handwheels, levers, handles, steel sheets including stainless steel—and the inside of tubes. They are built for both the wet and dry grinding method. In addition to the finishing of metal parts, they are used for plastics, hardened rubber, fibre, glass, etc. In fact, the applications are so numerous, only a few can be mentioned and shown on this page.

MATTISON GRINDING MACHINERY

Whatever your problems may be, it is well worth while to make an investigation as to the machine available for handling it.

SEND FOR *FREE* BOOKLET

Illustrates various applications of Mattison Grinding and Polishing Machines, built to secure best results from factory-coated abrasive belts. Also gives helpful data on grinding and polishing metals, plastics and other materials with abrasive belts. Write today for your copy.



MATTISON MACHINE WORKS
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Now! General Chemical Introduces

REVOLUTIONARY NEW PLASTIC CONTAINER FOR B & A Reagent Hydrofluoric Acid

Superior Strength
Molded in plastic for extra sturdiness and durability.
"Siphon Action" Lip
Allows accurate measure; draws back drops clinging to edge when pouring stops.
"Screw Tight" Cap
No leakage; protects purity of acid, prevents fuming and loss of strength.
STYLED FOR SAFETY
Entire unit of acid-proof polystyrene with advanced design pour-out, plus "non-tip" base!
Transparent
Acid level always visible.
B & A High Quality
Reagent HF meets exacting A.C.S. Specifications; Technical grades also available.
B&A
STANDARD OF PURITY
ACID HYDROFLUORIC, 48%
Reagent HF Code 1100
GENERAL CHEMICAL COMPANY

ANOTHER GENERAL CHEMICAL FIRST!

Latest development of General Chemical Company in the field of fluorides is this revolutionary new type of Hydrofluoric Acid container—prepared expressly for packaging Reagent HF produced by General's Baker & Adamson Division.

Laboratory chemists hail this transparent plastic bottle with its exclusive pouring and sealing features as an outstanding advancement which combines safety and utility to meet every requirement when using this corrosive acid.

Immediately available. . . . Why not order a standard carton of 25 one-pound bottles with the next lot of B & A quality reagents for your laboratory, or fill your requirements *now?*

Eliminates

Old-fashioned wax bottle for HF that has proved inadequate over the years.

★ No more worry about container when working with HF.

★ No more danger of bottle melting in summer or becoming brittle and cracking in winter.

★ No more risk of acid contamination in open bottle on the shelf.

★ No more problem and annoyance of not knowing amount of HF in bottle.

GENERAL CHEMICAL COMPANY

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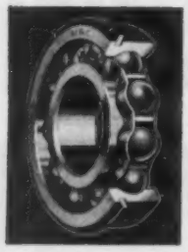
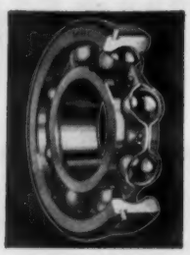
M-R-C BALL BEARINGS

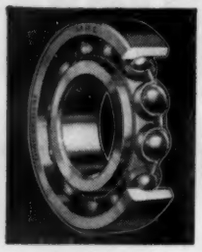
Complete Range of Types for All Requirements



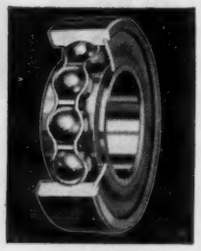
Maximum-Capacity Snap-Ring Type



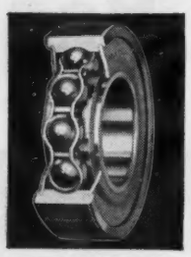
Super-Conrad Snap-Ring Type



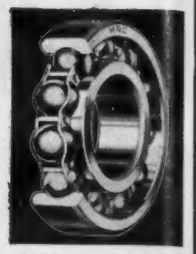
Radial Type R Maximum-Capacity



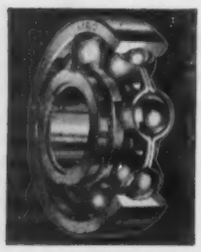
Maximum-Capacity Single-Shielded



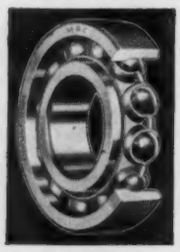
Maximum-Capacity Double-Shielded



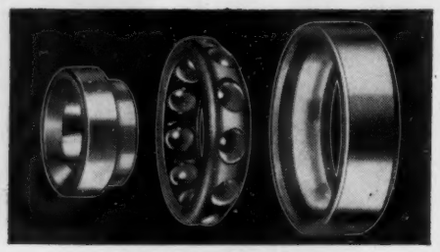
Maximum-Capacity Notched Type



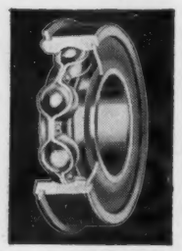
Adapter Type



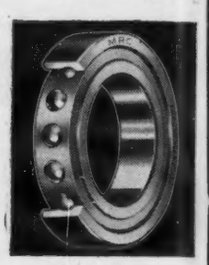
Radio-Thrust Angular-Contact



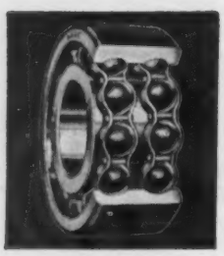
Front Wheel Bearings
Inner Race — Ball Retainer — Outer Race



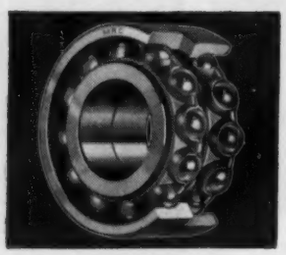
Super-Conrad Snap-Ring Type Single-Shielded



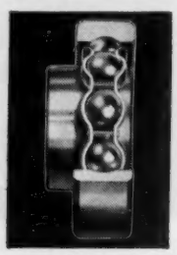
Single-Row Extra-Light Type KR



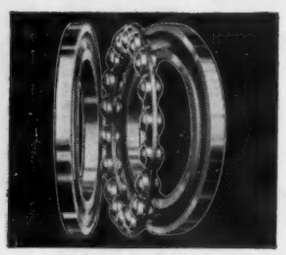
Double-Row Maximum-Capacity Type



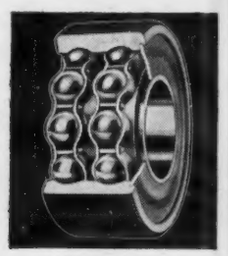
Duplex



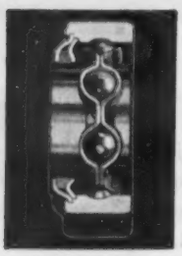
Wide-Inner Bearing



Thrust Bearing Flat Washer Type

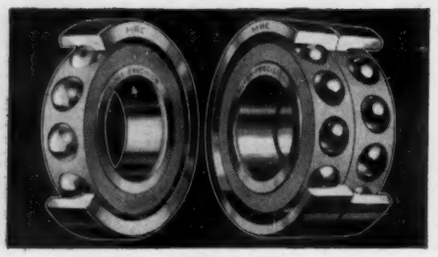


Double-Row Single-Shielded

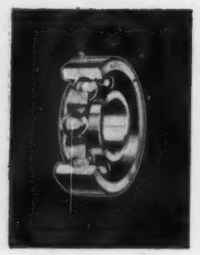


Fabri-Seal Type with Sealing Ring

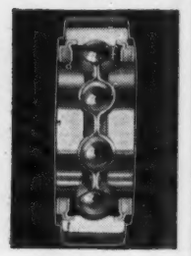
Extremely-Light Inch-Size



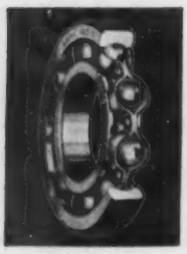
Super-Precision Bearings
Single Row — Duplex



Extra-Small (Miniature)

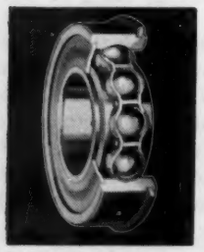


Double Felt-Seal Shielded Both Sides

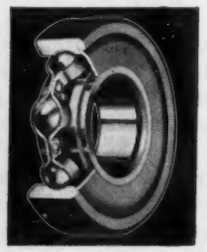


Narrow-Type Bearing

Super-Conrad Deep-Groove Type

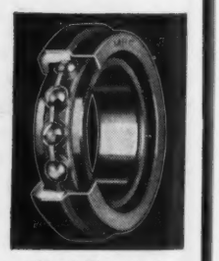


Max.-Capacity Snap-Ring Type Single-Shielded



Super-Conrad Type Single-Shielded

Clutch Throw-out Plain



Clutch Throw-out with Housing

MARLIN - ROCKWELL CORPORATION

Executive Offices: JAMESTOWN, N. Y.

Would You Believe—

THE RED HARVILL DIE CASTING PACKAGE PLAN

Eliminates 70% of Operations
Saves 90% of Floor Space
Cuts Production Cost 66%

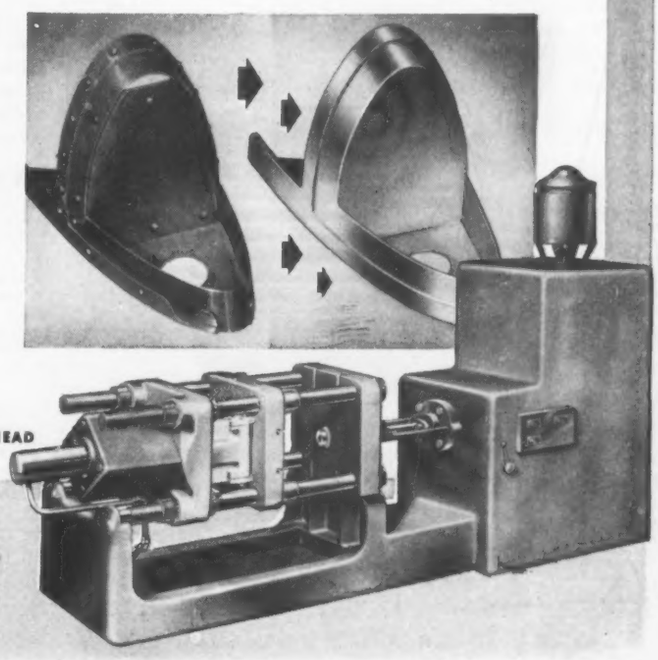
Yes, it's true—actual layout of a production line involving ten operations showed 7 could be eliminated by substituting the Harvill die casting machine package. Plus advantages include lower capital investment, lower inventories and increase in daily output. A cure for the "Reconversion Jitters" for this company!

See RED and be ready

If you manufacture from metal, discuss your plans now with Red Harvill and be ready to meet stiff competition in your post-war market by the use of die casting as your newest machine tool.

Die Casting Saved 38%

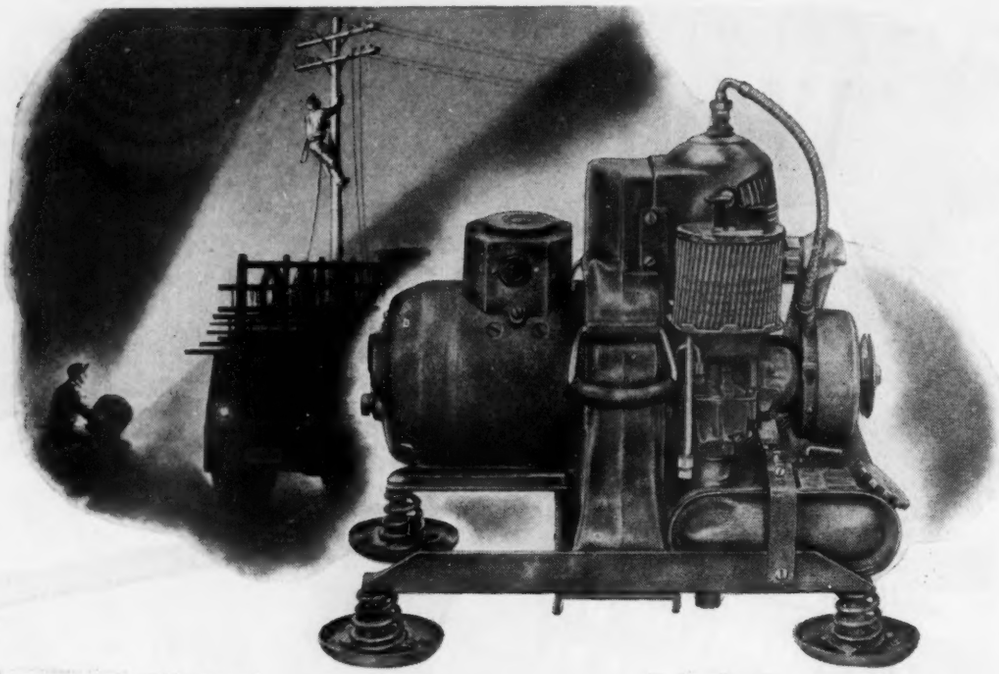
Case History No. 78. Sheet assembly of 6 pieces (left) requiring 30 rivets converted to one-piece die casting at saving of 38% and weight reduction of 27%. "Red" can do the same for you.



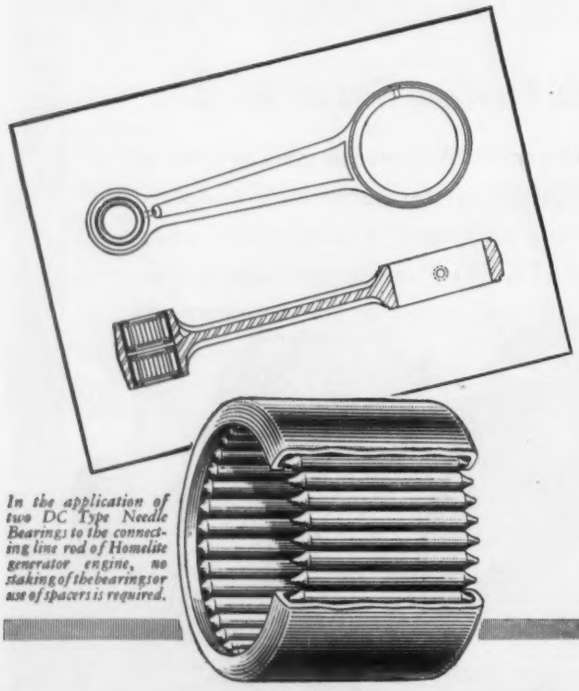
WRITE TODAY FOR BROCHURE ON FIRM LETTERHEAD

H. L. RED HARVILL MFG. CO.

POST OFFICE BOX 335-K VERNON, CALIFORNIA



Torrington Needle Bearings Double Life on Wrist Pins of Homelite Portable Generators



In the application of two DC Type Needle Bearings to the connecting line rod of Homelite generator engine, no staking of the bearings or use of spacers is required.

The wrist pin bearing of a gasoline engine always takes a beating! To give maintenance-free operation under the impact and stress of extreme service conditions, it must have ample capacity, adequate lubrication, and be designed for long life.

Two DC Type Torrington Needle Bearings in the wrist pin end of the connecting rod of Homelite Portable Generators were found to give *double* the service life in this application.

Can the use of these compact, low-cost, anti-friction bearings increase the performance, improve the efficiency or lengthen the service-life of your equipment? Our engineering staff will be glad to review the matter with you and, if indicated, to work with you in selecting the size and type to meet your design requirements. Write us today. Or, if you wish more preliminary information, consult the Torrington Needle Bearing Catalog No. 30-A. We will gladly send you a copy if you do not already have one on hand.

THE TORRINGTON COMPANY

Established 1866

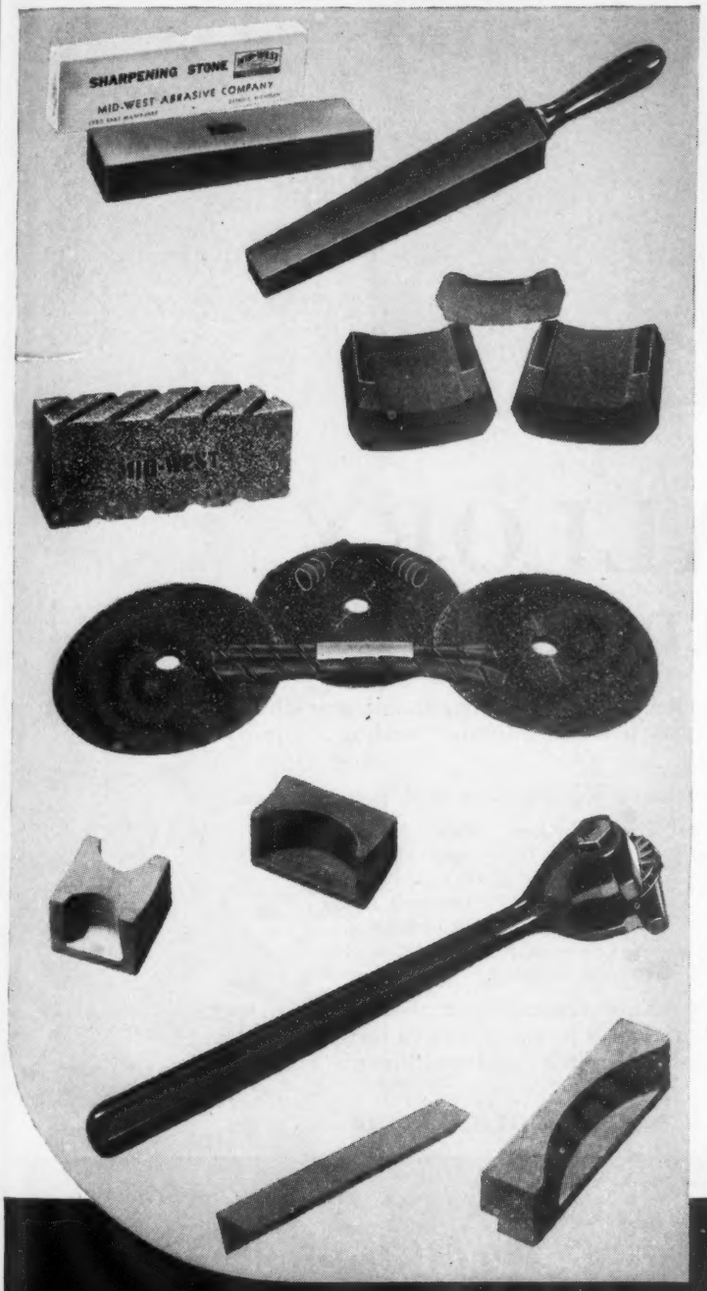
TORRINGTON, CONN. • SOUTH BEND 21, IND.

"Makers of Needle Bearings and Needle Bearing Rollers"

New York Boston Philadelphia Detroit Cleveland Seattle
Chicago San Francisco Los Angeles Toronto London, England

TORRINGTON NEEDLE BEARINGS

HIGH ★ ★ ★ *on the list*



● The superior quality of Mid-West Super-Cut grinding wheels and honing stones, backed by tests conducted under the most rigorous conditions, has placed them ace-high on the purchasing department's "appoved list."

Mid-West's staff of field experts is always available to solve your abrasive problems. And with the speed of delivery assured for every item in our line, the Mid-West Abrasive Company tops the source rating of many a wise buyer.

Let our engineers make a survey of YOUR plant and determine its abrasive needs. You'll find that your buyer, too, will look to Mid-West as a "preferred source" for dependable, wide-ranged abrasive products.

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Manufacturers of DEPENDABLE Abrasives

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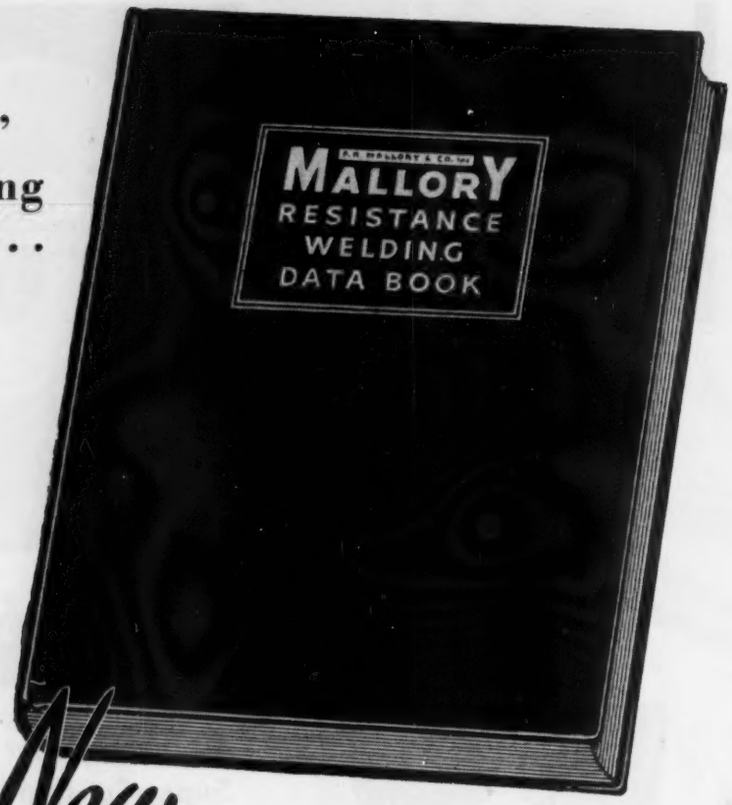
A "Must" for Welding Engineers . .



The New

MALLORY
RESISTANCE WELDING DATA BOOK

WRITTEN by experienced welding engineers and metallurgists, this new edition of the practical Mallory manual covers every phase of resistance welding . . . provides factual answers for hundreds of questions.

Included in the Third Edition Mallory Resistance Welding Data Book is material on

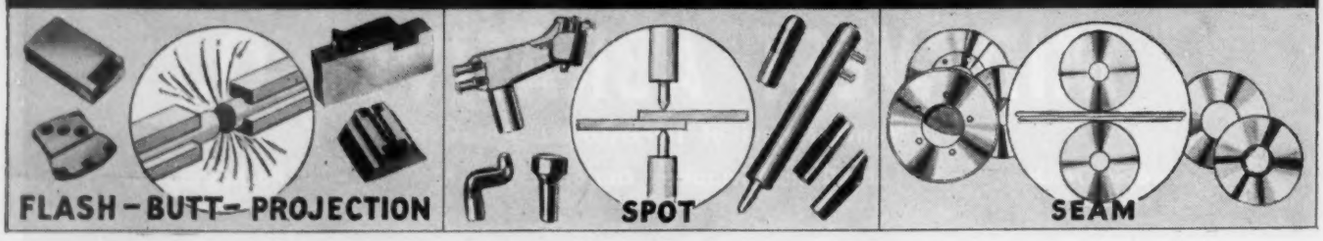
Welding Principles	Controls and Timing Devices	Cooling Methods
Heat Generation	Electrodes	Applications
Resistance Welders	Timing	Special Processes
Resistance Factors	Pressure	Electrode Alloys
Current Requirements		Definitions

Materials to be Welded: Ferrous and Non-Ferrous, Plated and Coated
Do's and Don'ts of Resistance Welding

This new Data Book is replete with tables, charts, diagrams and photographs of operations illustrating correct methods of welding. It will be sent gratis to resistance welding engineers when requested on company letterhead. Price to students, libraries and schools is $2.50 per copy, postpaid.

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

P.R. MALLORY & CO. Inc
MALLORY *Standard Resistance Welding Electrodes*



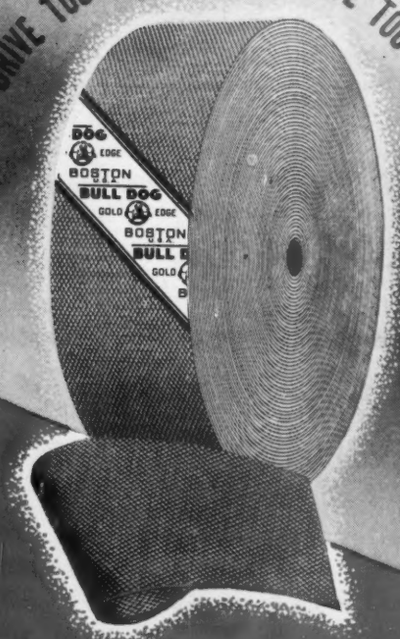
...IN SERVICE 15 YEARS

THIS Bull Dog Transmission Belt is operating on a Beater drive in a paper mill. This is a heavy duty job and the belt works under high stress.

Bull Dog meets the severest requirements of endurance, adaptability, long life, and minimum operating expense.

Bull Dog is widely used in paper and board mills, stone-crushing plants, cement mills, the lumber industry, ore-crushing and refining plants, brick plants, planing mills, and the textile industry. It is well worth your investigation for any driving need.

NO DRIVE TOO HARD • NO SERVICE TOO SEVERE



BOSTON WOVEN HOSE & RUBBER COMPANY

WORKS: CAMBRIDGE, MASS., U.S.A. P.O. BOX 1071, BOSTON 3, MASS., U.S.A.

Here are some of the ways

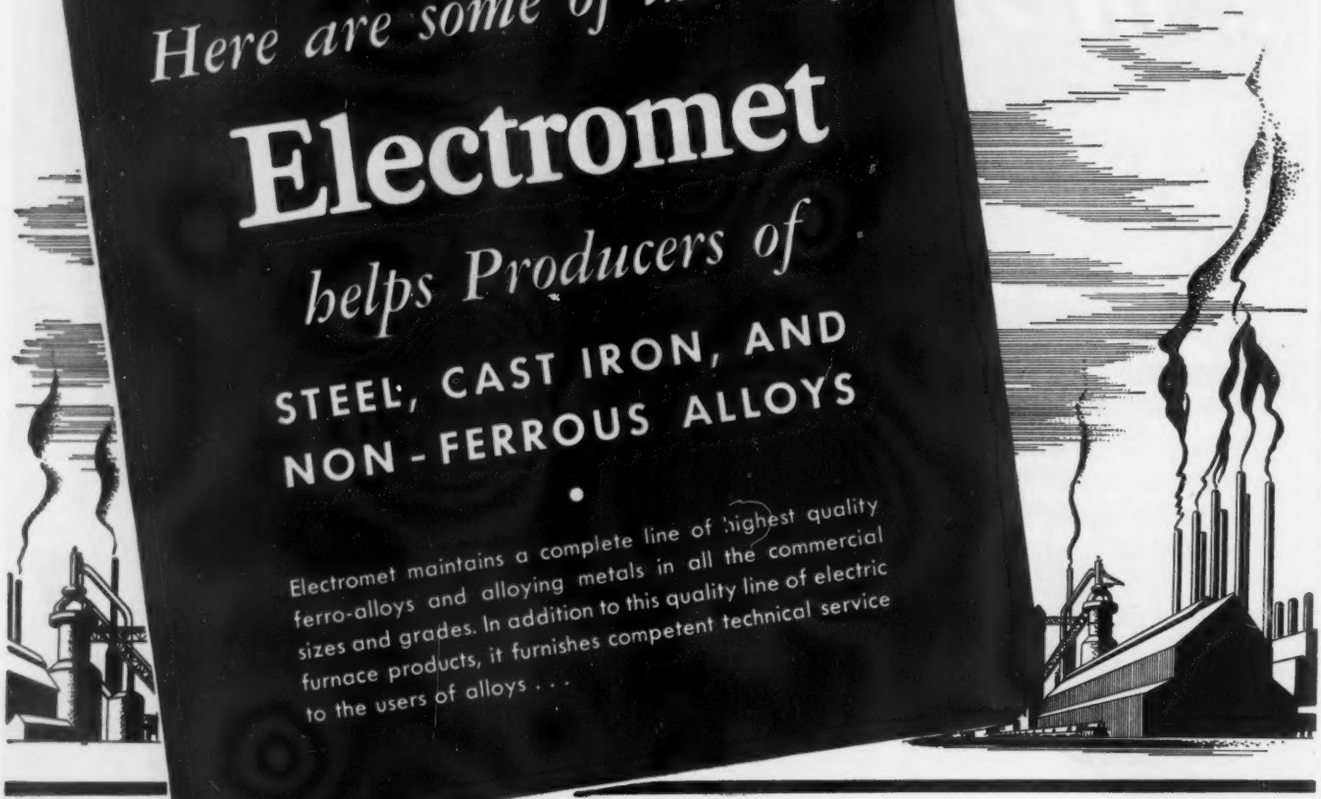
Electromet

helps Producers of

STEEL, CAST IRON, AND NON-FERROUS ALLOYS

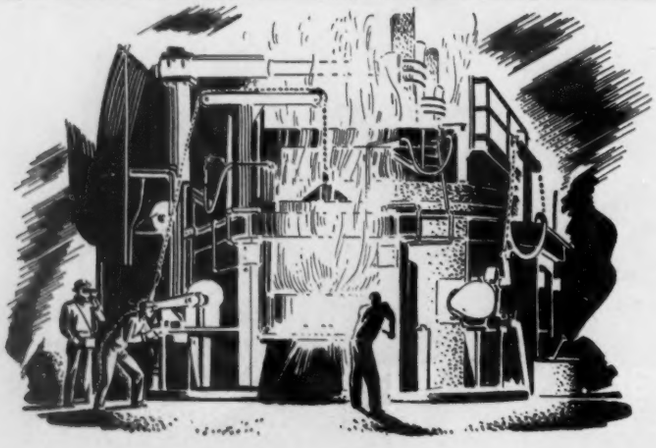
•

Electromet maintains a complete line of highest quality ferro-alloys and alloying metals in all the commercial sizes and grades. In addition to this quality line of electric furnace products, it furnishes competent technical service to the users of alloys . . .



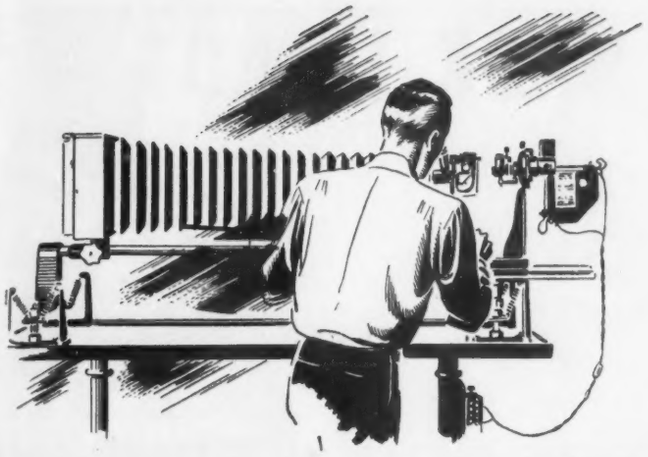
STRATEGICALLY LOCATED PLANTS, WAREHOUSES AND OFFICES

Electromet plants are located near the major iron- and steel-producing centers so that prompt delivery is possible. Warehouses in a number of cities supply users who need small shipments quickly. Conveniently located offices make it easy to secure reliable technical information and efficient service.



SKILLED FIELD METALLURGISTS

Electromet's staff of highly trained metallurgists is constantly available for consultation on the use of ferro-alloys. These men are trained in steel plant and foundry operations and have wide experience in the technical problems involved in the production of steels, irons and non-ferrous alloys.



GOOD RESEARCH FACILITIES

Field metallurgists are backed up by well-equipped and well-staffed research laboratories which develop new alloys and their efficient application. Pioneers in this work, they have developed low-carbon ferro-alloys, silico-manganese, Silcaz and Silvaz alloys, calcium metal, calcium-silicon, calcium-manganese-silicon, and ferrocolumbium, and others are constantly in process of development.

TECHNICAL LITERATURE

Electromet makes available many booklets and reprints which are authoritative guides for the use of ferro-alloys in steel plants and foundries. These booklets are based on many years of practical metallurgical experience. Typical titles are: "Chromium in Cast Iron," "Vanadium in Iron and Steel," and "Electromet Products and Service."

MARKET PROMOTION FOR ALLOY STEELS AND IRONS

Electromet maintains a broad market promotion program for increasing the end-uses of alloy steels and irons. This program includes a consulfing engineering service; business paper advertising; a monthly publication, ELECTROMET REVIEW; and numerous booklets.

BUY UNITED STATES WAR BONDS AND STAMPS

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by cleaning them

The JENNY Steam-Spray Way—

8 to 10 times faster than hand methods

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Hypressure Jenny steam cleaning before repairs saves the 25% to 40% of mechanics' time which actual time studies show is lost in wiping grease and dirt from machinery, parts, tools, and equipment. And Jenny's highly atomized mixture of steam, hot water, and cleaning compound sprayed under pressure, so completely removes grease and dirt that cracks or defects are often revealed for repair before actual breakdowns occur.

Jenny can help *you* cut "down time" and put *your* machines back in action quicker. Write for complete information.

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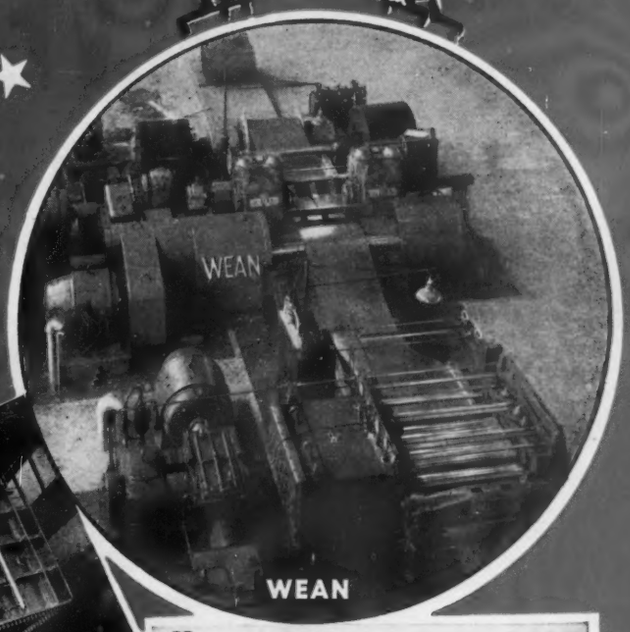

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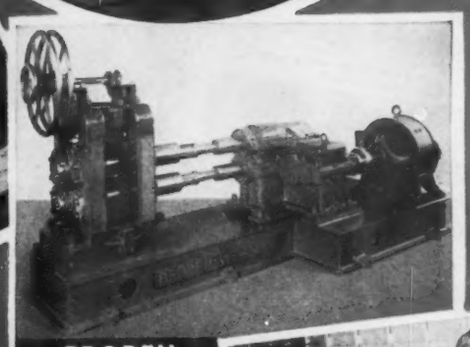
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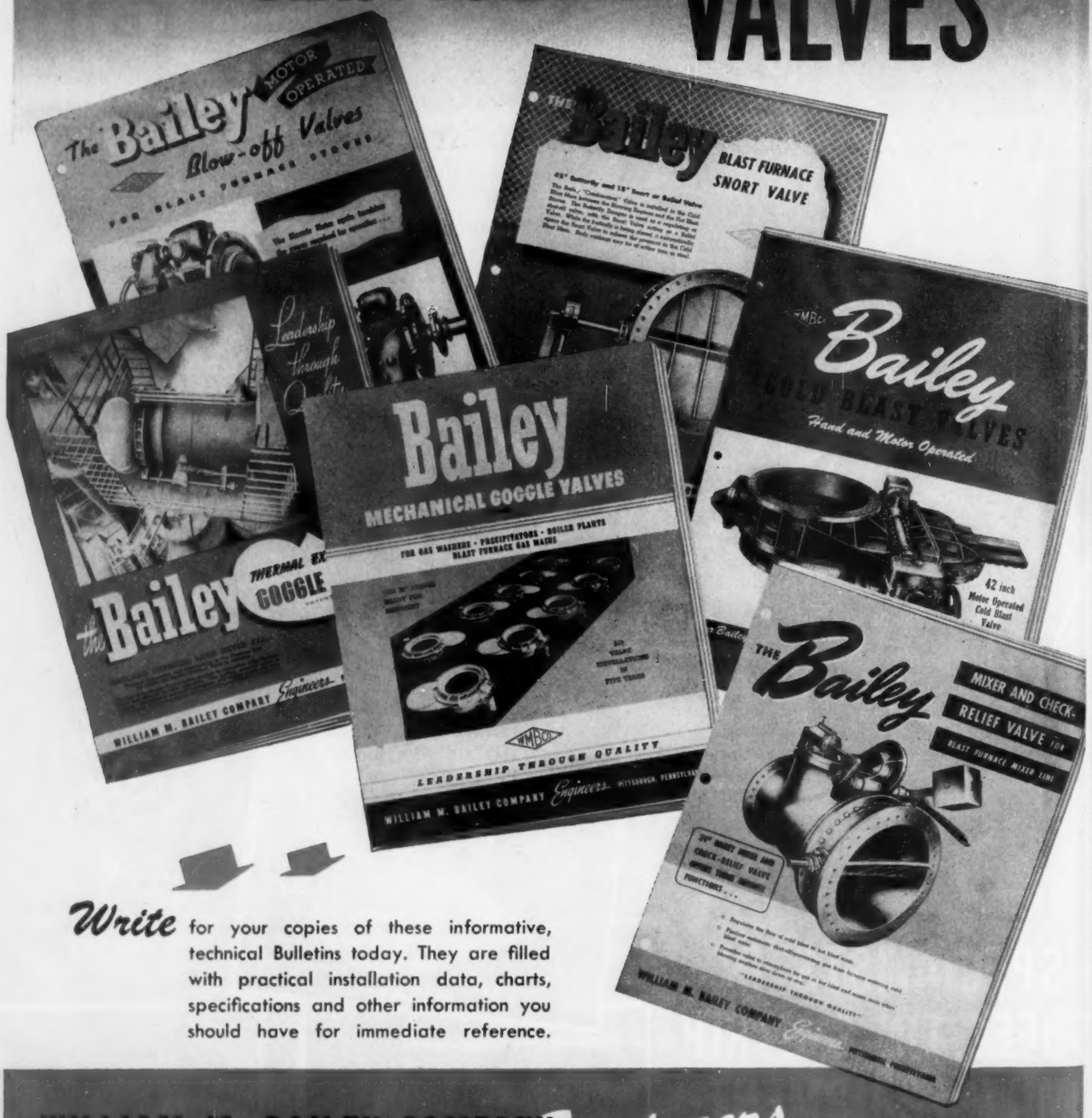

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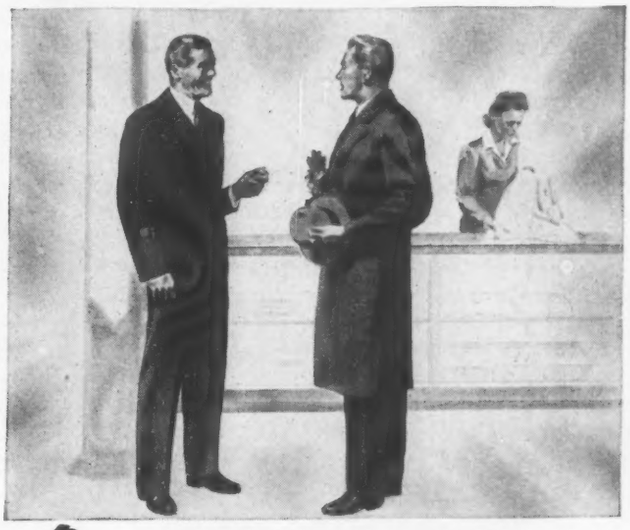
1. *A business man asks . . .*

2. *A professional man inquires . . .*

3. *An architect wonders . . .*



4. *A department store manager asks . .*

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Certainly! We've never been *out* of the elevator business, although our engineering and manufacturing facilities have been working 100% for the Armed Services.

It is true that we have manufactured vast quantities of parts for guns, ships and aircraft for the Army, Navy and Air Corps but, because vertical transportation is essential in the production and handling of munitions of war and in the operation of aircraft carriers, we have continued to produce a large volume of passenger, freight and special purpose elevators.

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Now CARBIDE
THREAD MILLING CUTTERS

5

FIRSTS BY PLAN-O-MILL

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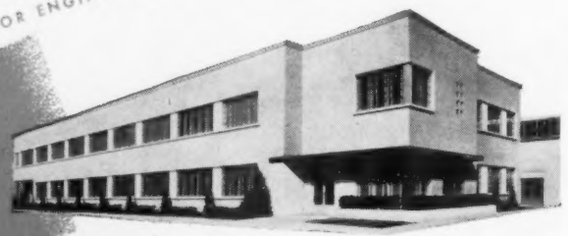

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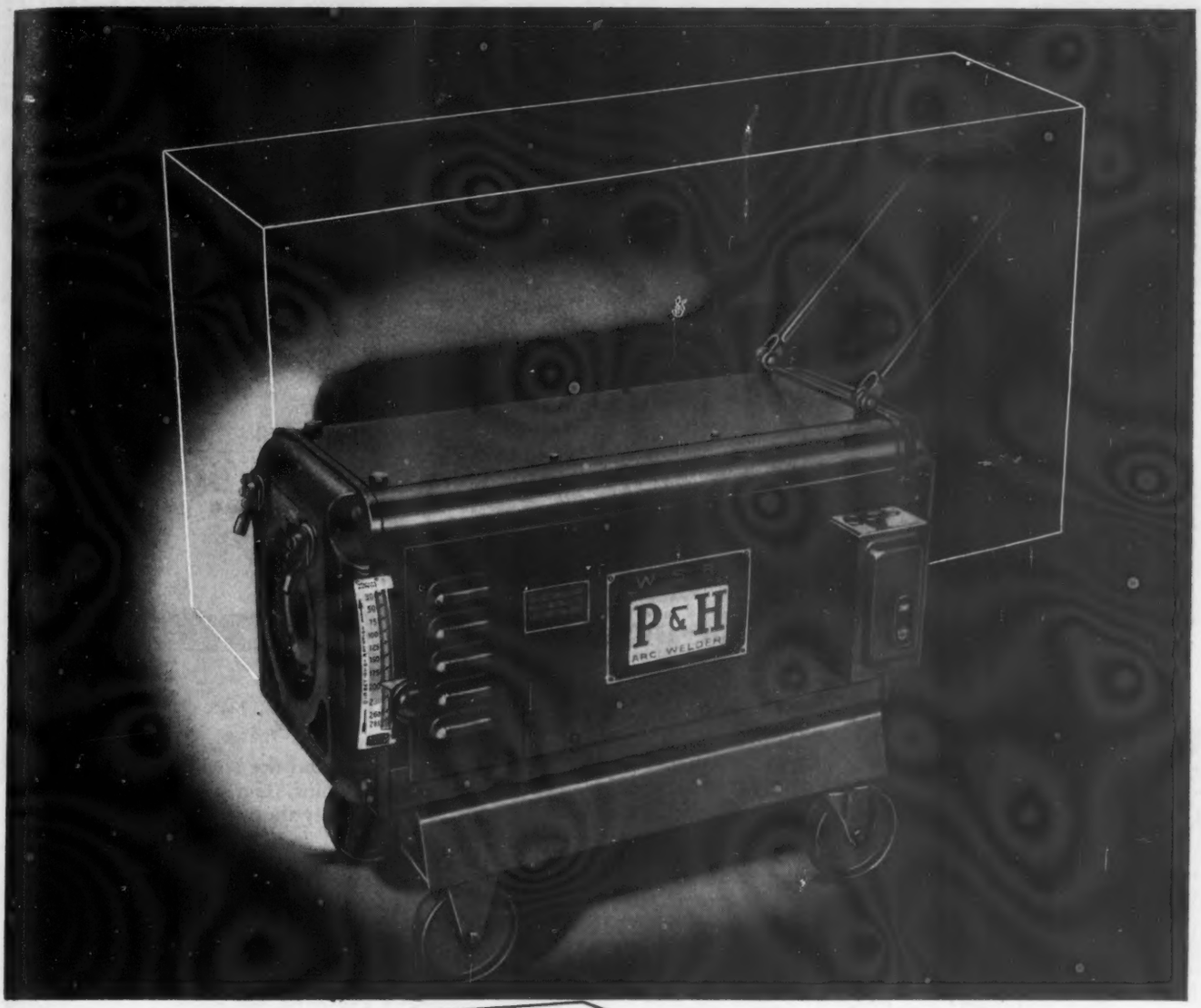

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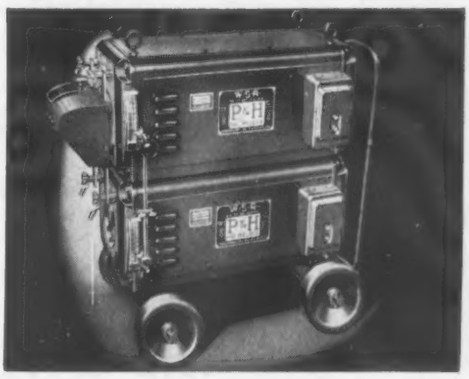

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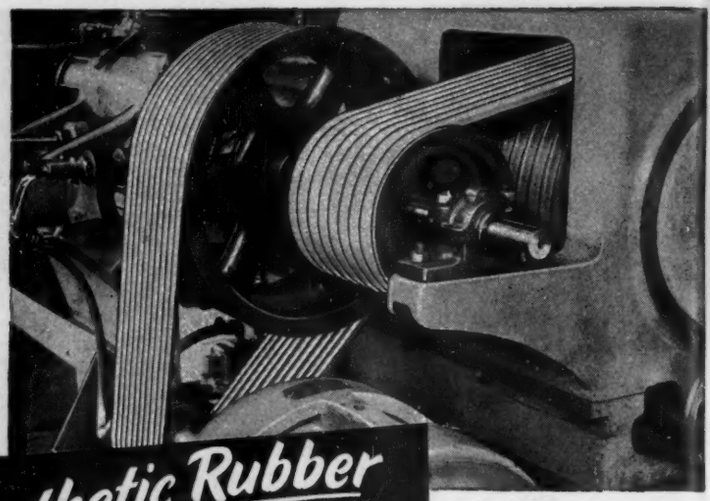

Here Is the ***Simple Reason*** *Why*

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—Are Giving You Even *BETTER SERVICE* Than *Pre-War Belts* of *NATURAL RUBBER!*

NO ONE, before the war, had ever built a V-Belt that could stand the service now required by the Army's tanks, tractors, and self-propelled big guns. Gates has developed V-Belts that are now serving on army combat units all over the world—and has built these belts of synthetic rubber!

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It is only rarely, of course, that improvements developed primarily for army combat use can be passed on immediately to the general user—but there are very good reasons why Gates has not been called upon to withhold these important V-Belt improvements from Industrial V-Belt users.

The plain fact is that no guns, no tanks, no airplanes can be produced unless V-Belts are supplied to drive the producing machines. It is equally clear that better V-Belts than ever before have been urgently needed to keep machines going on the forced-draft, war-production schedules that have had to be maintained 24 hours a day!

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For Postwar Planning ... consider STAMCO'S complete line of Slitters and Resquaring Units.

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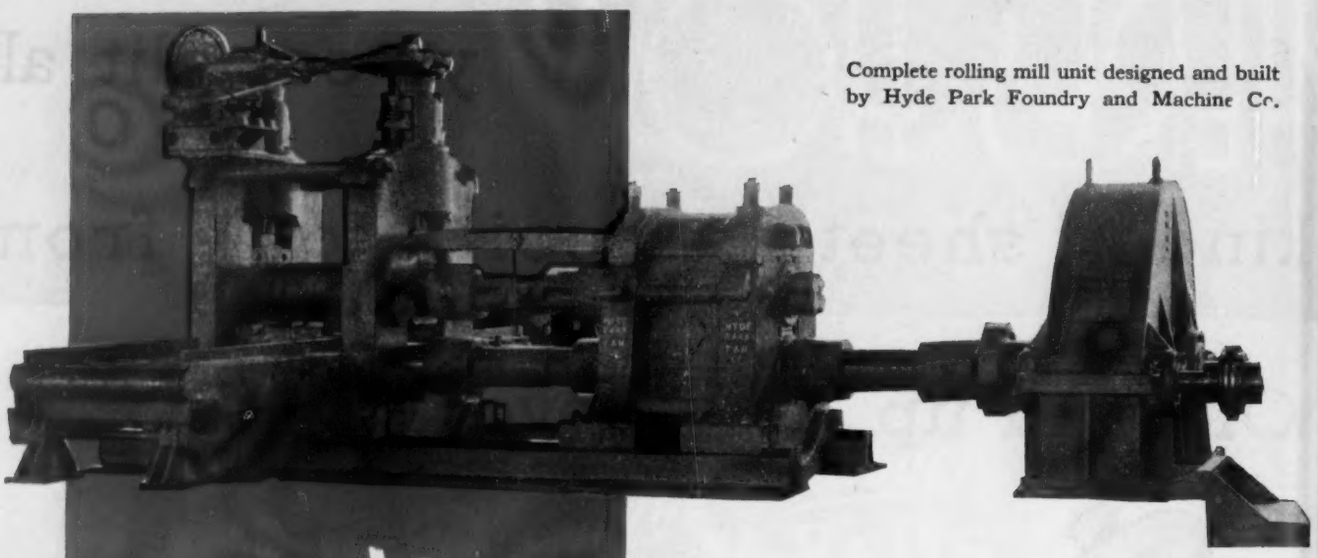

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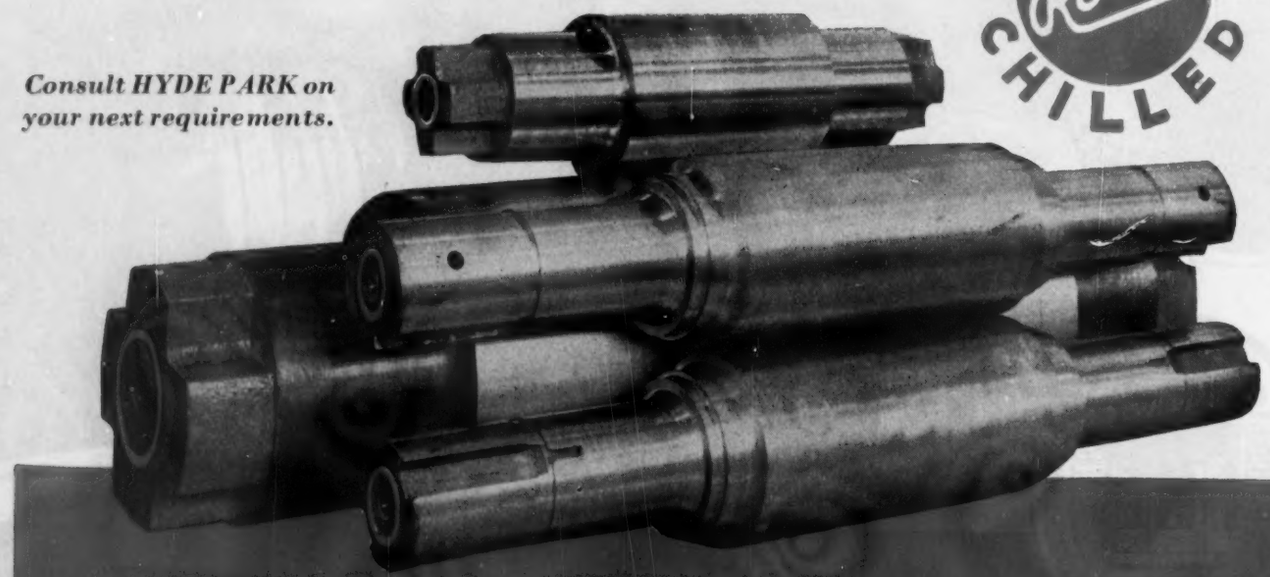

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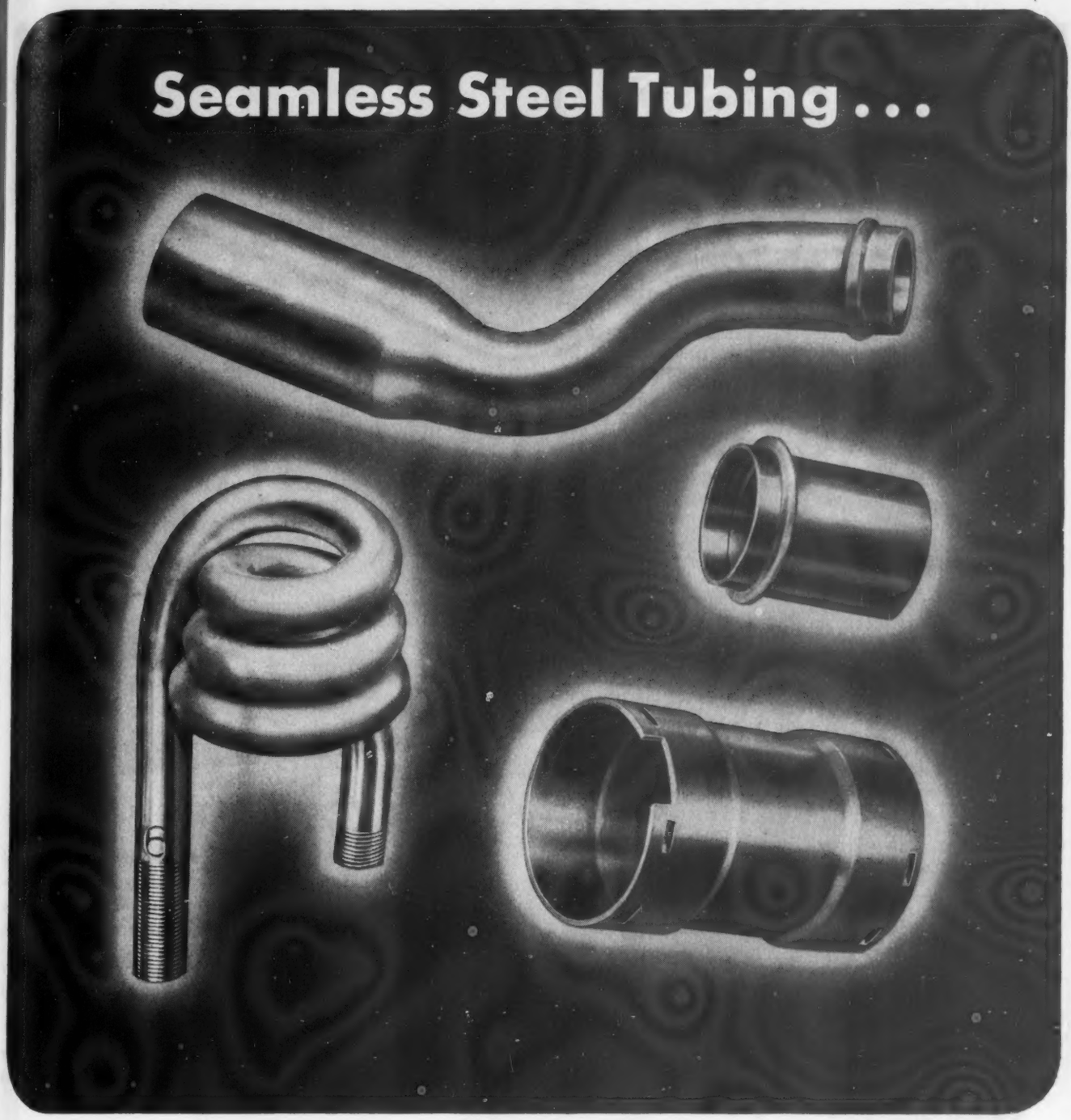

A Versatile Stock in any Plant

In the mechanical field there is practically no end to the number and variety of uses to which seamless steel tubing can be put—and profitably, too!

Designers and engineers are constantly adding to the number of parts using seamless steel tubing as raw stock. The controlled physical properties and uniform structure of seamless tubing renders it ideal for such operations as upsetting, beading, flaring, threading, swaging, bending, and forming. It also adds strength while reducing weight and eliminating many machining operations. Let Michigan Seamless engineers tell you how seamless steel tubing can serve *you*.

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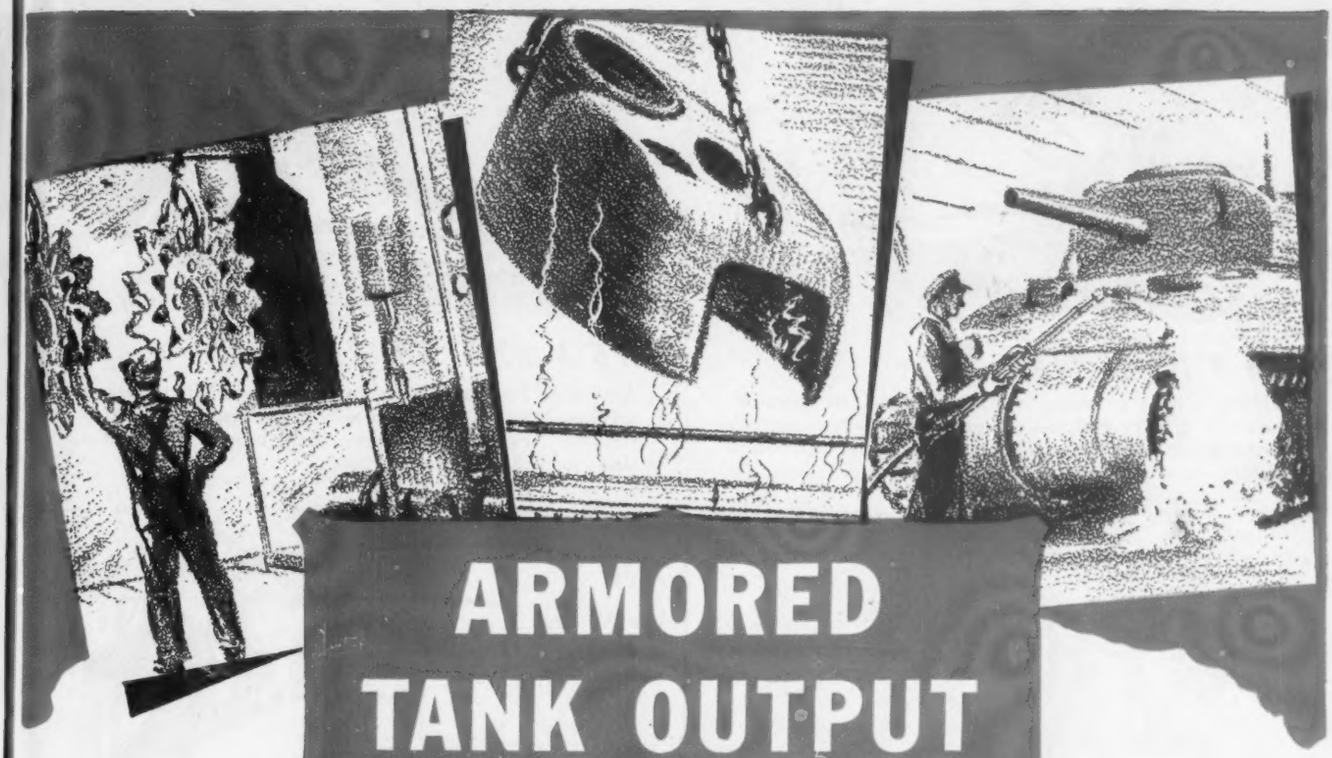

ARMORED TANK OUTPUT SPEEDED BY

OAKITE CLEANING

On every battlefront the General Sherman Tanks are delivering a Victory punch. In the home front tank arsenals specialized Oakite cleaning materials and techniques speed the Shermans along the assembly line, viz.:

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Each of these Oakite cleaning techniques is designed for a specific job . . . each provides maximum results. Cleaning costs are well within specified limits. Whether you make tanks, components or other war supply items, our "know-how" and successful experience are freely at your service through your nearby Oakite Technical Representative. Inquiries invited . . . promptly answered.

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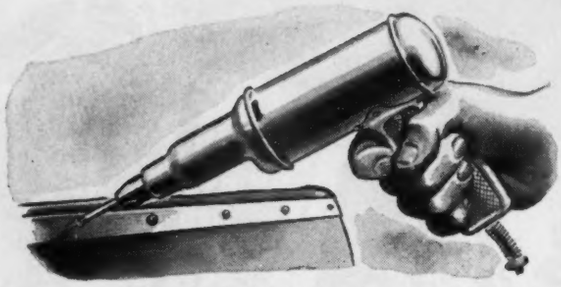
IT'S A TIME SAVER!

So long as his plant stuck to slotted screws, this assembly man had to stick to hand driving. Too much danger of power drivers skidding and gouging the carriage's finished surface – making costly refinishing necessary.



IT'S A MONEY SAVER!

A shift to Phillips Screws permitted a switch to power driving. Thanks to the Phillips Recess, driver skids stopped. Result: a fast, money-saving process instead of a slow, high-cost hand operation!

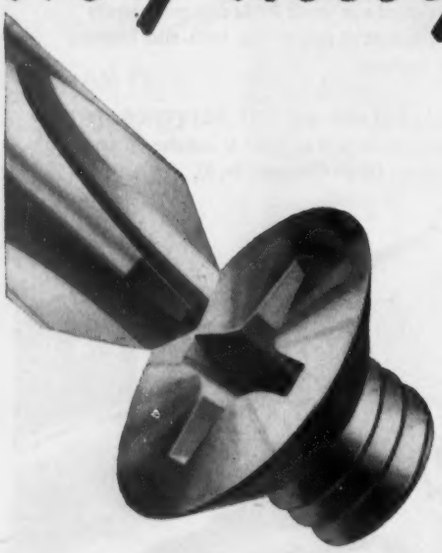
IT'S A PROBLEM SOLVER!

Management and workers aren't the only ones who benefit from Phillips Screws. Design Engineers find there's no easier way to plan extra fastening strength and rigidity into a modern streamlined product – and to lower costs at the same time!

IT'S A SALES BUILDER!

To salesmen, too, use of Phillips Screws pays dividends: in a stronger, smarter product . . . that has no burred screw heads to disfigure surfaces and snag clothing. Ornamentally as well as functionally, this recess is engineered to SELL your product!

It's Phillips — the engineered recess!



In the Phillips Recess, mechanical principles are so correctly applied that every angle, plane, and dimension contributes fully to screw-driving efficiency.

. . . It's the exact pitch of the angles that eliminates driver skids.

. . . It's the engineered design of the 16 planes that makes it easy to apply full turning power – without reaming.

. . . It's the "just-right" depth of recess that enables Phillips Screw Heads to take heaviest driving pressures.

With such precise engineering, is it any wonder that Phillips Screws speed driving as much as 50% – cut costs correspondingly?

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Made in all sizes, types and head styles

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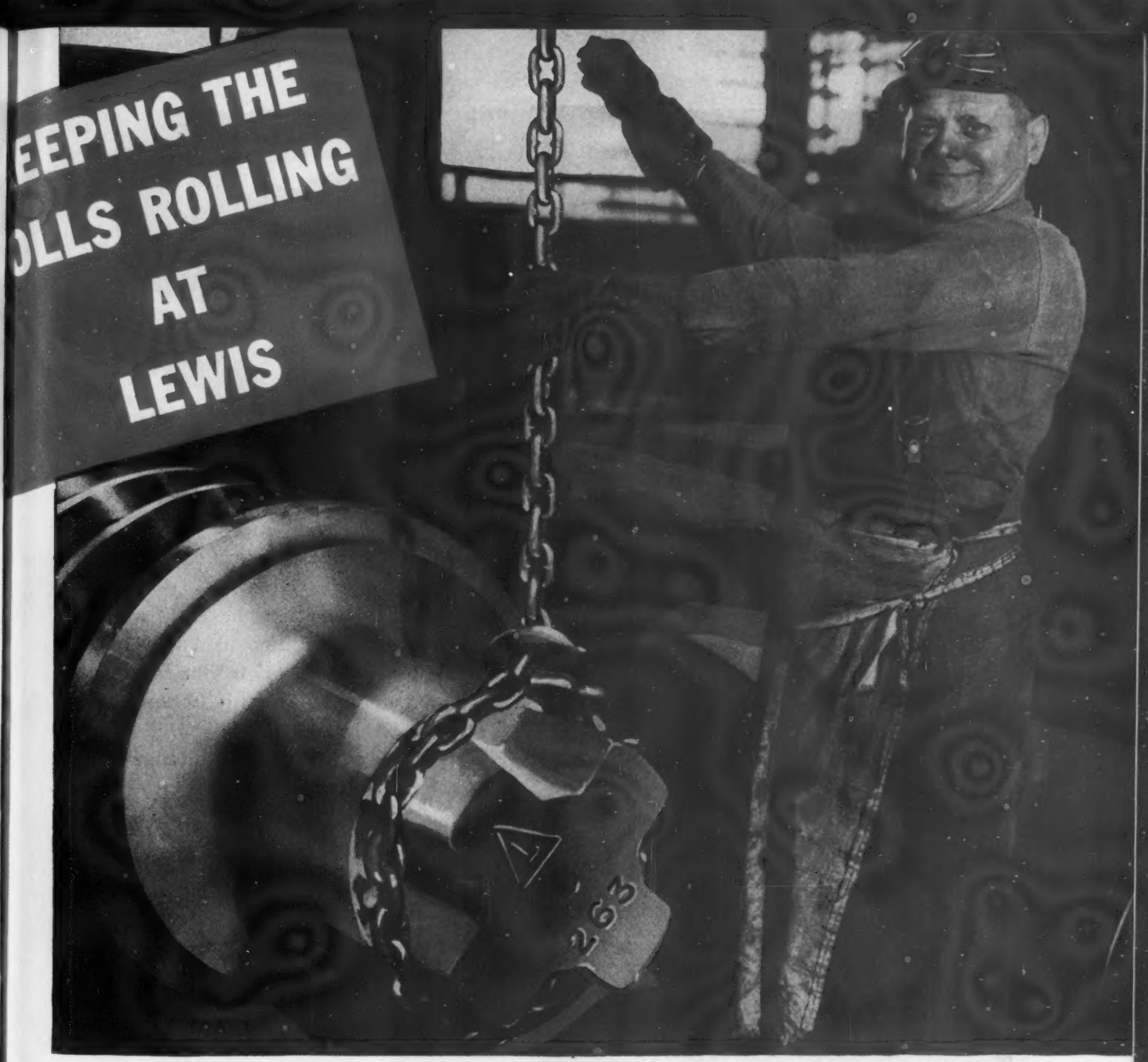

This Charlie Hopey is quite a Guy!

★ ★ ★ ★ ★ ★

Charlie, now 58 years young, has been with Lewis for 21 years and still takes pride in his job as a hand finisher on rolls. Charlie's record at the plant is a fine one—Take a look at his Service Flag too! *Six sons in the armed forces!* . . . a 17-year-old with a Naval Hospital unit in the East . . . a 20-year-old in the South Pacific . . . a 22-year-old with the Navy in European waters . . . a 23-year-old and a 24-year-old in the European invasion operations . . . a 26-year-old in Hawaii.

Next time you install a new Lewis Roll take a look at that fine finish —it might be the work of Charlie Hopey!

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of BLAW-KNOX Company, Pittsburgh, Pa.

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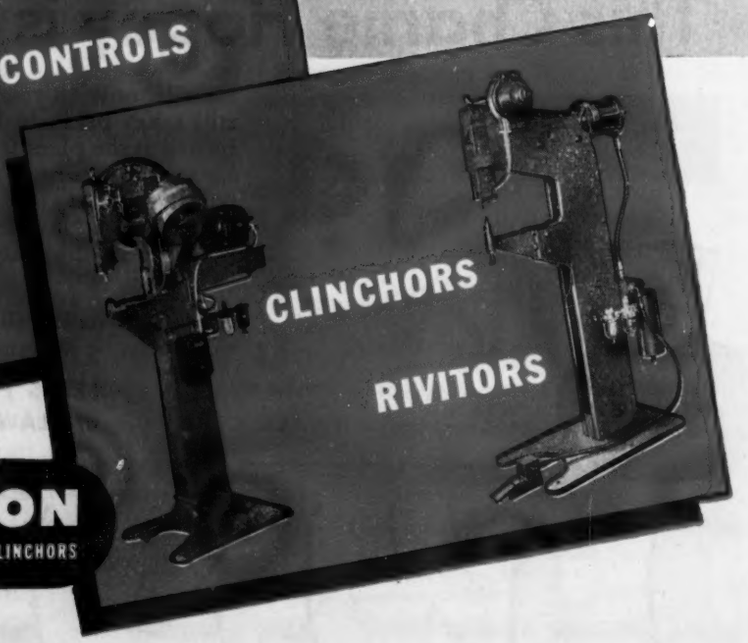
for the iron, steel and non-ferrous industries

LEWIS ROLLS



T-J PERFORMANCE UPS PRODUCTION CUTS COSTS!

● T-J Products have shown outstanding ability to "take it" . . . performing tough jobs for industry with unbeatable *accuracy, efficiency* and *dependability!*

That's why more and more practical production men *specify* T-J where there's a job for Rivitors . . . hydraulic cylinders . . . or air cylinders . . . cutters . . . Clinchors . . . or air controls. All T-J Products expertly engineered . . . precision-built . . . rigidly inspected . . . right in every respect! Send for latest bulletins. The Tomkins-Johnson Company, Jackson, Michigan.

T-J

TOMKINS-JOHNSON

RIVITORS . . AIR AND HYDRAULIC CYLINDERS . . CUTTERS . . CLINCHORS

DRESSER RINGS

A RELIABLE AND COMPETENT SOURCE FOR RINGS, WHEELS, FRAMES and RING ASSEMBLIES

Dresser Rings are rolled, welded and sized to close tolerances from bar, strip, plate and special sections. Careful inspection at all stages of production assures quality and uniformity.

Our engineers will help you in redesigning your product for welded construction from ring elements for greater strength and economy.

Send us your inquiry for any size or cross section. No quantity too large.

Over fifty years' experience in the manufacture of rings for well known Dresser Pipe Coupling and Repair Products. Catalog 437-S on request.

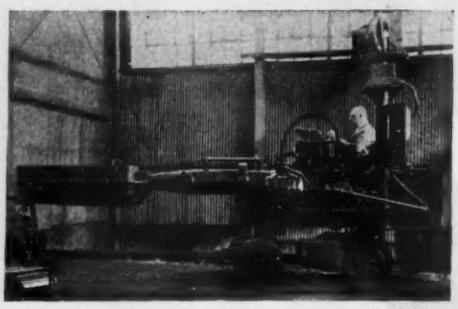
DRESSER MANUFACTURING CO.
BRADFORD, PENNSYLVANIA

A FEW EXAMPLES OF DRESSER-MADE RINGS AND ASSEMBLIES

BROSIUS AUTO FLOOR CHARGING MACHINES

Brosius Auto Floor Charging Machines are designed to handle charging boxes for charging melting furnaces or are equipped with tongs for handling billets, etc., serving mills, furnaces, hammers, presses, etc. They are driven over the floor by an electric motor while the steering, tongs, and peel motions are actuated by oil cylinders. Electric power is received from the plant supply through a rotating collector on the machine or from a machine mounted gasoline driven generator.

Figure 1 (left) shows a charging machine handling a conventional charging box and having a rotating peel. Figure 2 (right) shows a modification of the usual melting furnace



charger, being used in charging aluminum melting furnaces and ferro-silicon open top furnaces. In this design, instead of using a rotating peel and a standard charging box, we provide an open end box and pusher for pushing the material from the box.

BROSIUS AUTO FLOOR MANIPULATORS

Figures 3 and 4 show Brosius Auto Floor Manipulators used for manipulating the piece while being forged under a hammer or press. The machine in Figure 3 has a capacity of 2000 lbs., while the one in Figure 4 has a capacity of 6000 lbs., but they are built in

capacities up to 20,000 lbs. Both machines shown receive their power from a machine mounted generator driven by a gasoline engine. They are driven over the floor by an electric motor, while all other motions, including steering, are actuated by oil cylinders.

All of these Brosius Chargers are now being used in the United States and other United Nations in the production of armament and munitions, but they will be equally adaptable to peacetime production.

Brosius Equipment is covered by patents, allowed and pending, in the United States and Foreign Countries.

Edgar E. BROSIUS Company

MANUFACTURERS AND DESIGNERS OF SPECIAL EQUIPMENT FOR BLAST FURNACES AND STEEL MILLS

PITTSBURGH, SHARPSBURG BRANCH, **PA.**

Brosius Equipment is constantly being improved to meet new and more difficult requirements of present-day production.

Trained
FOR THE JOB

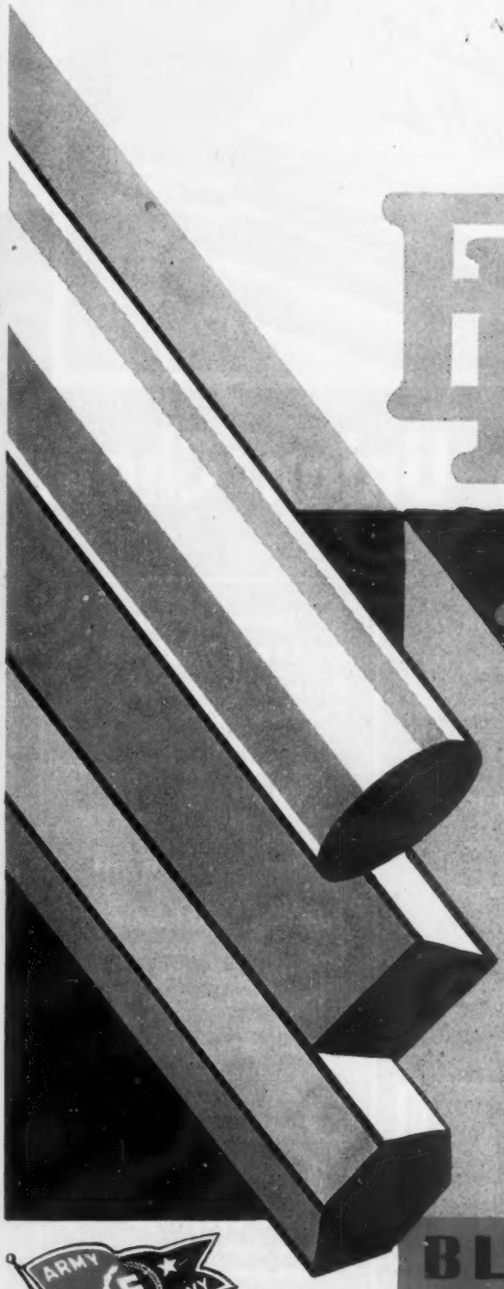
B&L

Strain-Tempered STEELS

. . . are furnace treated Bar Steels for exacting applications. Like the modern "dogs of war" they are developed to meet and master all the hazards of service.

These specialized steels will be highly important in the post-war period when revised costs of finished parts must be considered. With improved machinability to speed up production . . . with strain relief to eliminate distortion in machining . . . with modified physicals, not obtainable in "as-rolled" cold drawn bars . . . these B&L Strain-Tempered Steels will contribute to lower fabrication costs.

Modern furnace equipment, closely controlled methods of treatment, final checking and inspection of bars by precision instruments, all help to insure uniform results. Steel-using industries can well profit from the use of B&L Strain Tempered Bars.



ARMY E NAVY

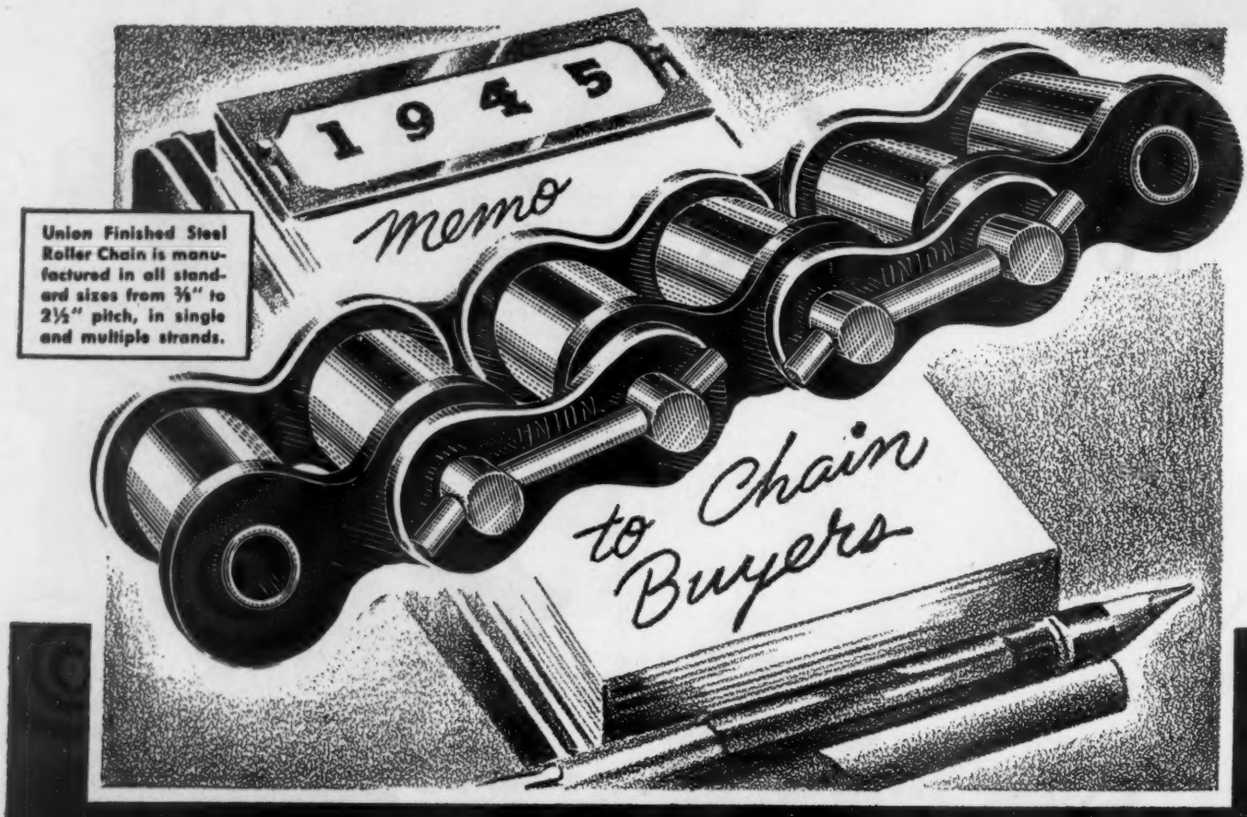
If you can't do the bombing
. . . you can do the buying
. . . of more WAR BONDS!

BLISS & LAUGHLIN, INC.

HARVEY, ILL. • BUFFALO, N. Y. • MANSFIELD, MASS.

Sales Offices in all Principal Cities

COLD FINISHED STEEL AND SHAFTING

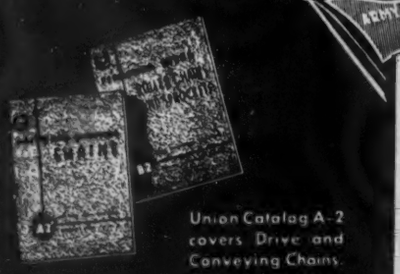


Union Finished Steel Roller Chain is manufactured in all standard sizes from ⅜" to 2½" pitch, in single and multiple strands.

A Good Year To Buy Union Chain

Because this year will bring peace much nearer, if not actually realized, and our thinking will turn more to the making of products for use in the postwar world. The same Union Chains now being assembled as integral parts of many war machines will be ready to perform similar operations in peacetime products and to accept assignments of power transmission and materials handling in their production. Every year is a good year to buy Union because Union Chains and the organization by which they are made have a reputation with chain buyers for "wearing well".

The Union Chain and Manufacturing Company ..... Sandusky, Ohio, U. S. A.



Union Catalog A-2 covers Drive and Conveying Chains. Catalog B-2 covers Finished Steel Roller Chain and Sprockets. Ask for your copies.

ARMY E NAVY

UNION CHAINS

Union Chains for Every Application

Drive and Conveying Chains and Sprockets

- Bridge Chain
- Combination Malleable Iron and Steel Chain
- HB (hardened bearing) type chain
- BP (bar and pin) type chain

★

Finished Steel Roller Chains and Sprockets

- All manufacturer's standard, size ⅜ in. to 2½ in. pitch
- Single and Multiple Strands
- Extended Pitch Series in sizes 1¼ in. to 4 in. pitch

★

Silent Chain and Sprockets

- All sizes ⅜ in. to 1½ in. pitch

★

Flexible Couplings

- Roller chain type
- Silent chain type

At Last

a standard marking system for grinding wheels

Quick, easy, understandable information on everything anyone needs for specifying, buying and using grinding wheels features this new Standard Marking System. Devised and adopted by the Grinding Wheel Manufacturers Association, it will be Standard for all manufacturers.

For the convenience of customers, until the new uniform system becomes universal, Abrasive Company wheels will bear two markings — one according to the old system, one according to the new.

Users are cautioned that while *wheels of different makers may be marked alike, they will not necessarily grind alike.* In selecting wheels therefore, it is always advisable to consult the Abrasive Company's Grinding Wheel Data Book Supplement which lists General Recommendations, using the New Marking System, for a wide range of materials and jobs.

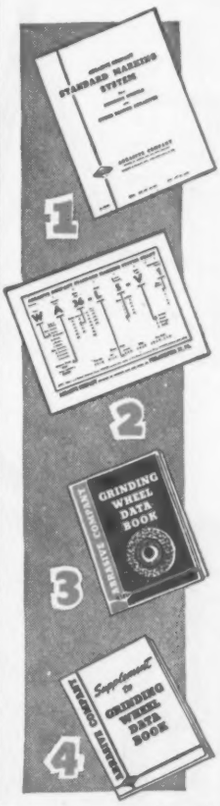
The Abrasive Company Diamond Trade-Mark on any Borolon (aluminum oxide) or Electrolon (silicon carbide) Wheel is assurance of accurately controlled manufacture according to specifications indicated by the Marking. Performance in use is demonstration of Abrasive Company outstanding quality.

abrasive Company

Abrasive Company, Philadelphia 37, Pa.
Division of Simonds Saw and Steel Company

DISTRIBUTORS IN ALL PRINCIPAL CITIES

SEND FOR THESE NEW ABRASIVE COMPANY GUIDES TO THE NEW MARKING SYSTEM



1 — This folder describing and illustrating the New Standard Marking System and showing how it differs from Abrasive Company's former system should be in the hands of every buyer and user.

2 — This handy simple chart for desk or wall provides ready reference to the New Standard Marking System. Get one for everyone in your plant who is concerned with Grinding Wheels.

3 — This Abrasive Company 120 page GRINDING WHEEL DATA BOOK is an authentic manual. Complete descriptive data on the use and application of grinding wheels and other Abrasive Company Products.

4 — This new supplement to the GRINDING WHEEL DATA BOOK contains wheel selection table giving general grain and grade recommendations according to the New Standard Marking System for 177 grinding classifications.

CLIP COUPON AND MAIL

ABRASIVE COMPANY, PHILADELPHIA 37, PA.

Please send Guides to New Marking System as follows:

No. 1 ☐ No. 2 ☐ No. 3 ☐ No. 4 ☐

NAME_____

ADDRESS_____

Sulphite-Treated
Alloy and Special Steels

BENEFITS TO USERS

- ✓ 25% Greater Machining Speed
- ✓ 200% Longer Tool Life
- ✓ Fewer Rejections
- ✓ More Uniform Physical Properties
- ✓ Fewer Operations
- ✓ Better Finished Product

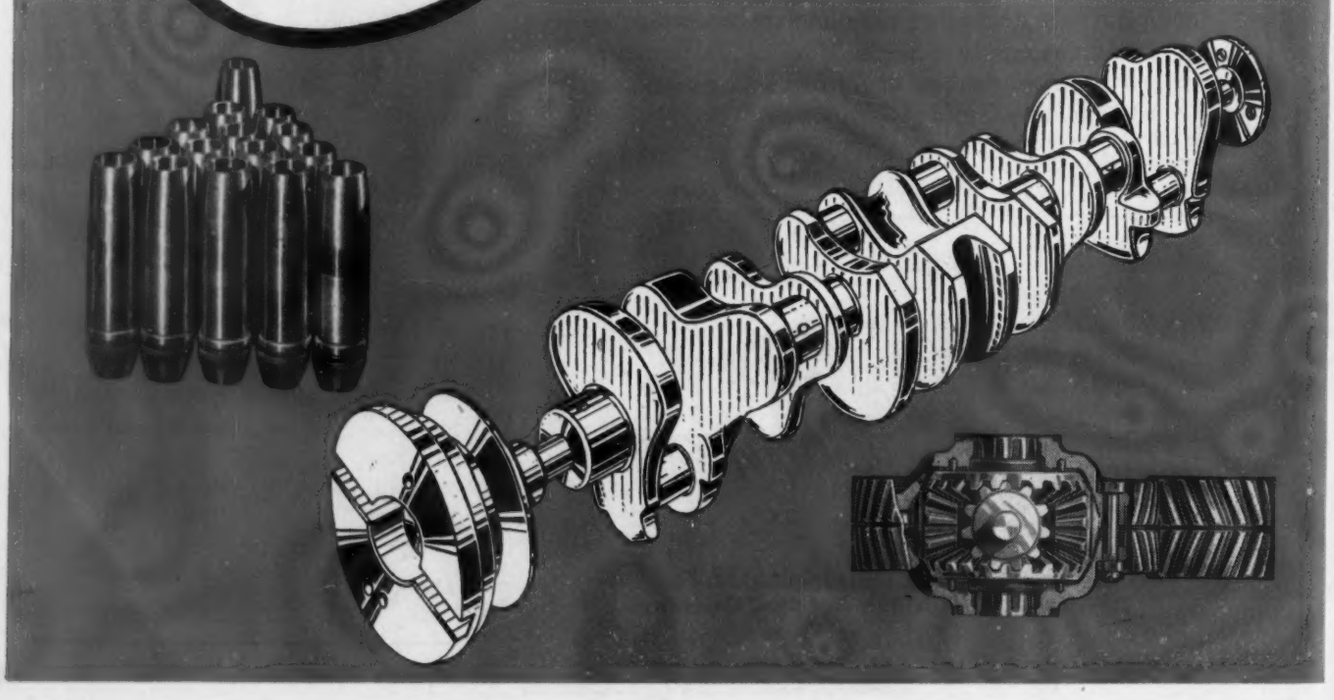
SULPHITE-TREATED alloy and special steels, which we have produced for a number of years, have solved many problems for steel users. They have been most satisfactorily applied where machinability is of first importance.

Sulphite treatment can be applied to most types of steel. It has been used successfully in the production of shells, crankshafts, camshafts, axles, and gears.

If you believe that your company may have an application for sulphite-treated steels, our sales and metallurgical staffs are at your service. We have accomplished satisfactory results for others and are ready to serve you in the same way.

WISCONSIN STEEL COMPANY

Affiliate of International Harvester Company
General Offices: 180 North Michigan Avenue, Chicago 1, Illinois



Setting Performance Records for Precision Machining

South Bend Precision Turret Lathe in the Factory of the Republic Aviation Corporation

High precision and close tolerances have always been the watchwords of the aviation industry. But with the war came demands for higher speeds and better performance. This meant that even closer tolerances had to be established and maintained through the greatest production schedules in history. We are proud that providing lathes to meet the exacting requirements of warplane production is one of our important assignments. Throughout the aviation industry South Bend Lathes are setting enviable performance records for precision machining.

In all metal working industries, South Bend Lathes are giving the same dependable service that they are giving in the aviation industry. Versatile and efficient, they are also used for emergency service work by the Armed Services. They travel with the Army in compact mobile machine shops. Many fighting ships of the Navy have one or more South Bend Lathes on board for making emergency repairs at sea. They are used by the Air Forces in repair bases here and overseas—sometimes even flown by plane for emergency service in remote locations.

Now, as before Pearl Harbor, our entire factory is devoted to the production of South Bend Lathes. No other product is made by us. There has been no lowering of standards because of wartime restrictions and shortages. The use of substitute materials is negligible, limited to a few non-essential parts such as name plates, paint, etc. Improvements have been accelerated. Today, South Bend Lathes are better in every way.

South Bend Engine Lathes and Toolroom Lathes are made in five sizes: 9″, 10″, 13″, 14½″, and 16″ swing. Precision Turret Lathes are available in two sizes: Series 900 having 9″ swing with ½″ collet capacity, and Series 1000 with 10″ swing and 1″ collet capacity.

NEW CATALOG NOW READY!

Write For It!

Illustrated in full color—this new 64-page catalog shows all types of South Bend Lathes. Also shows complete line of accessories and attachments for use with these lathes. *Ask for Catalog No. 100-D.*

Lathe Builders For 38 Years

SOUTH BEND LATHE WORKS

429 East Madison Street • SOUTH BEND 22, INDIANA

SIMONDS *Fighting* GEARS

★ *with* ADVANCED ENGINEERING
THAT MAKES FOR EVEN GREATER PEACETIME RELIABILITY!

For more than fifty years we have offered our experience and master craftsmanship in building reliable gears of various sizes and types to meet specific needs—in fact, Simonds even cut 12 feet diameter spur gears!

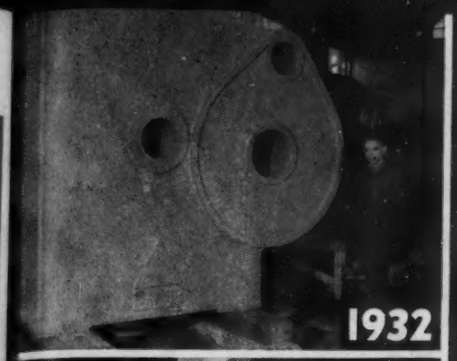
In the Simonds plant we readily handle any commercial material used for gears, such as cast and forged steel, gray iron, bronze; silent pinions of steel, rawhide and bakelite. In other words—Simonds Gears meet the most severe wartime or peacetime demands!

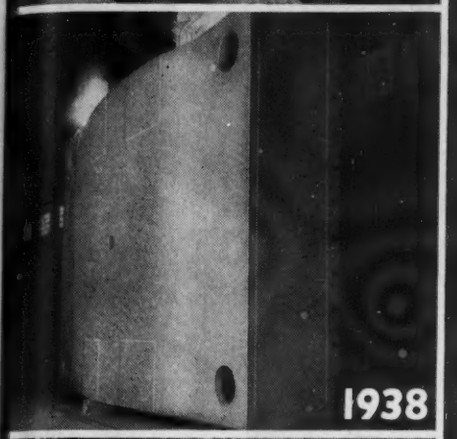
MEMBER OF AGMA

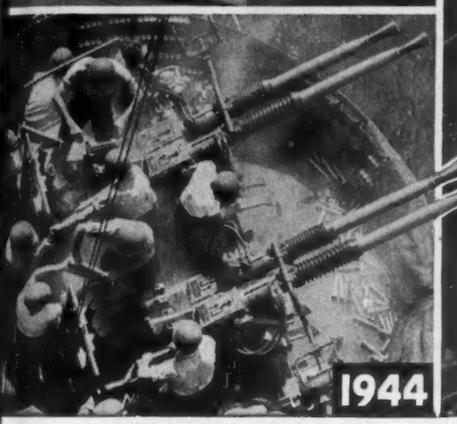
THE SIMONDS GEAR AND MANUFACTURING COMPANY

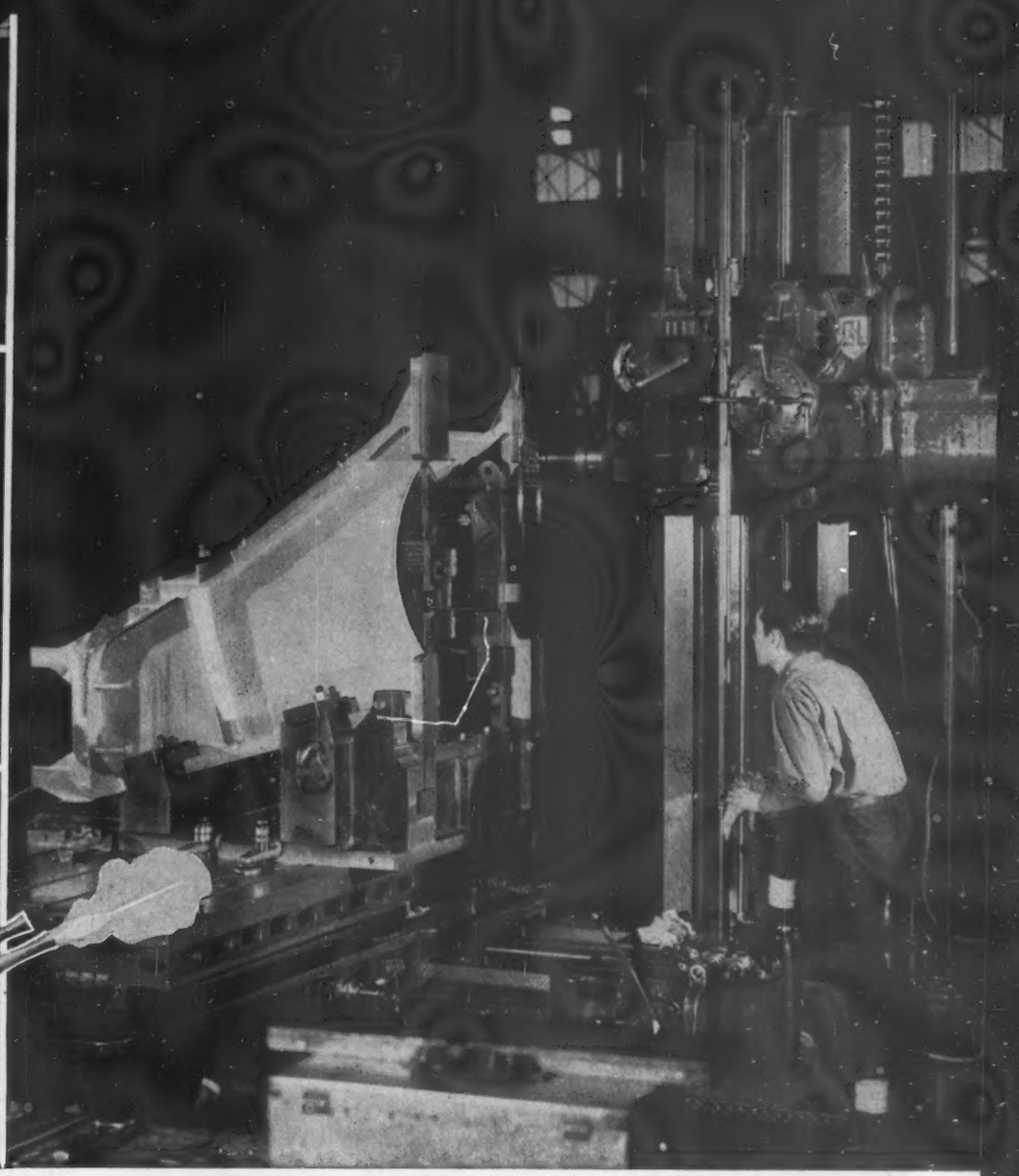
LIBERTY AT TWENTY-FIFTH STREET · PITTSBURGH 22, PA.

Distributors: Ramsey Silent Chain Drives and Couplings









AN ADDED SERVICE
TO THE RETOOLING OF AMERICA

When the day comes this company will have: Welding facilities for production of structures of any shape and any size within transportation limits. Machine tool facilities to machine them. Engineering service skilled in machine design to assist you.

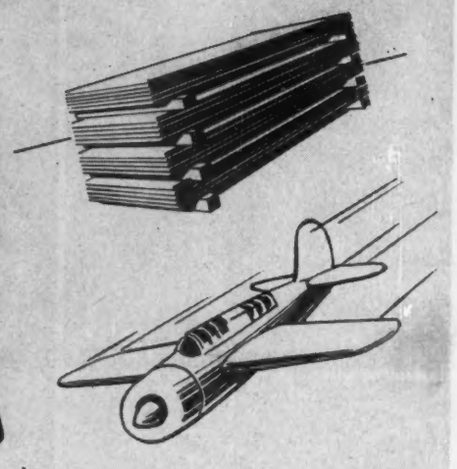
We will be glad to get in touch with you at any time.

DANLY MACHINE SPECIALTIES, INC.
2100 SO. 52nd AVE. *CHICAGO 50, ILLINOIS*

DANLYWELD

Danly Die Sets • Die Makers' Supplies • Welded Steel Fabrication

JESSOP Stainless Steels

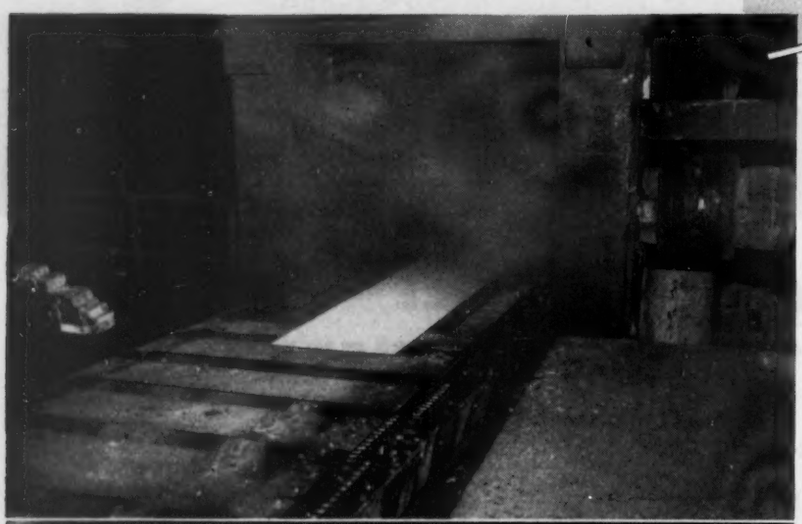


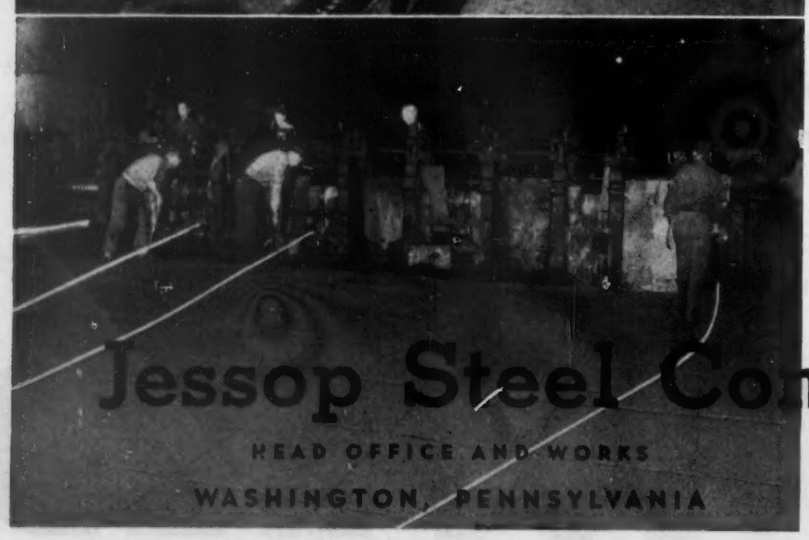
NOW . . GREATER AVAILABILITY

WPB regulations have been relaxed to include the availability of Jessop Stainless Steels for additional uses.

NOW . . QUICKER DELIVERY

Quicker deliveries of Jessop Stainless Steels are now possible, for the situation regarding this strategic material is less critical now than it has been at any time during the past several years.





Wherever corrosion is encountered, and heat resistance and high strength are necessary, you will find Jessop Stainless Steel the most economical metal to use. It also has the advantages of appearance and its durability reduces the need of expensive replacements.

Our metallurgical and engineering staff are ready to advise which type will best fit your need.

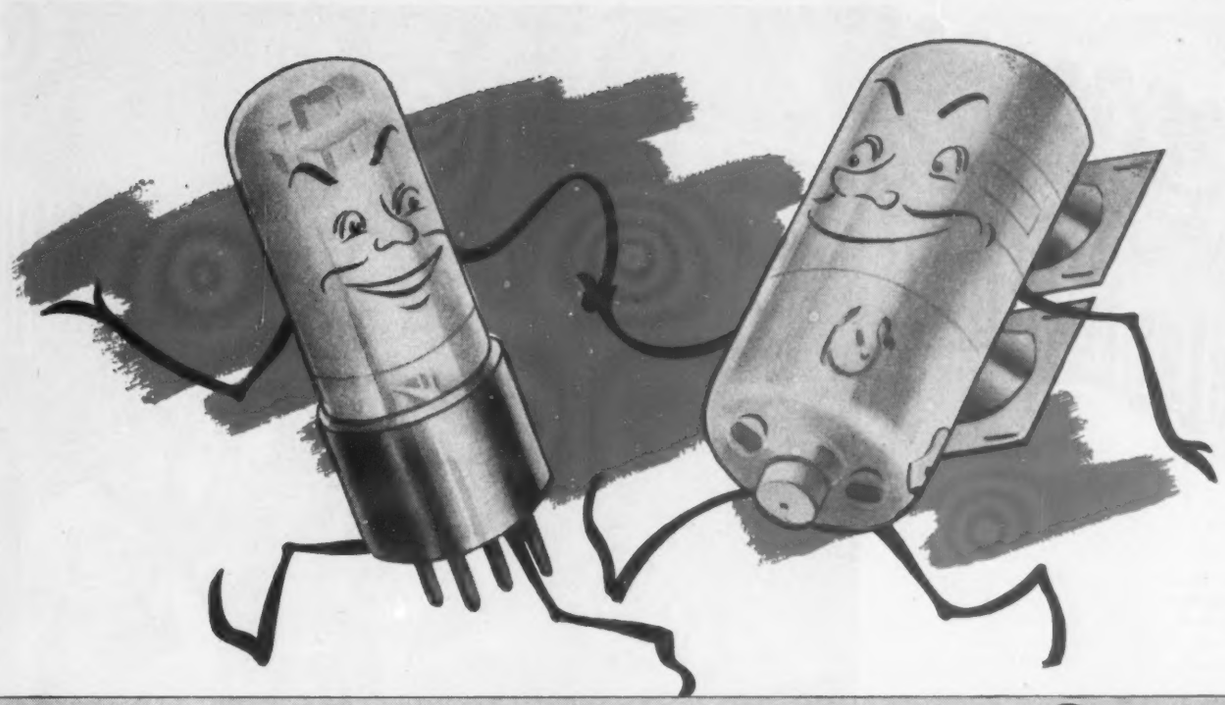
Bars • Billets • Sheets • Strip • Plates
Special Shapes • Castings • Circles • Rings
Flanged and Dished Heads
Centerless Ground and Cold Drawn Bars

Jessop Steel Company

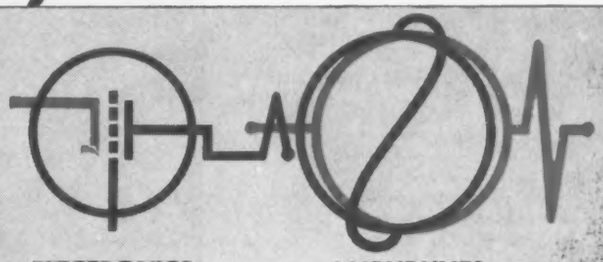
HEAD OFFICE AND WORKS
WASHINGTON, PENNSYLVANIA

ARMY E NAVY
JESSOP STEEL CO.
JESSOP
WASHINGTON, PA.

Established 1901



What will this pair do next?



GUN turrets, ship steering mechanisms, paper-machine drives, steel-mill flying shears—these are examples of where the partnership of electronic tubes and G-E amplidynes is *already* doing several important control jobs.

To picture the possibilities *ahead*, consider how this unusual partnership works:

First, the milliwatt output of a phototube, selsyn, resistor, tachometer, or other sensitive measuring device is amplified electronically to about one watt. Thus, your original signal may be initiated by a light, color, or temperature; by motion; or by changes in power or speed.

Second, this one-watt current gets another powerful boost (is multiplied 10,000 times or more) from the G-E amplidyne, which thus furnishes the kilowatts required to drive or control industrial machines. Because of the extremely fast and accurate response of both electronic tube and amplidyne, the slightest change in the original milliwatt signal causes a corresponding, precisely proportioned change in the amplidyne's kilowatt output.

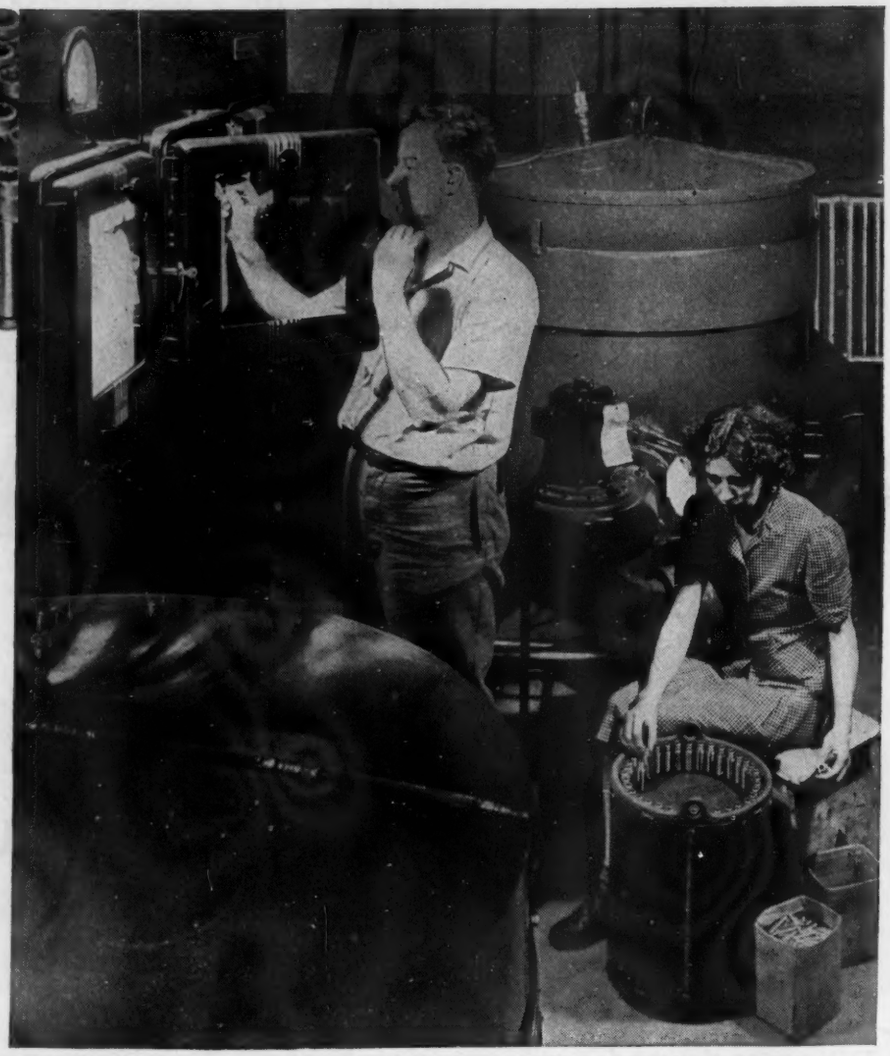
This means that machine tools, continuous processes, materials handling—to say nothing of countless steering or positioning operations—can be made more automatic and more precise, and with fewer parts, than was ever before thought possible.

To help you use the amplidyne in harnessing the magic of electronics to industrial needs, we've prepared a booklet which explains how the amplidyne works, and shows where it has been—and can be—applied. Ask for Bulletin GEA-4186. *General Electric Company, Schenectady 5, N. Y.*

Buy all the Bonds you can
and *keep all you buy*

GENERAL ELECTRIC 750-244-3923 **AMPLIDYNES**

Above, rotors for airplane engine fuel pumps made by Pesco Products Co. Div. of Borg-Warner. The material is a nitridable alloy steel, and mechanical tolerance as to taper is only one-tenth, or 0.0001 inch.



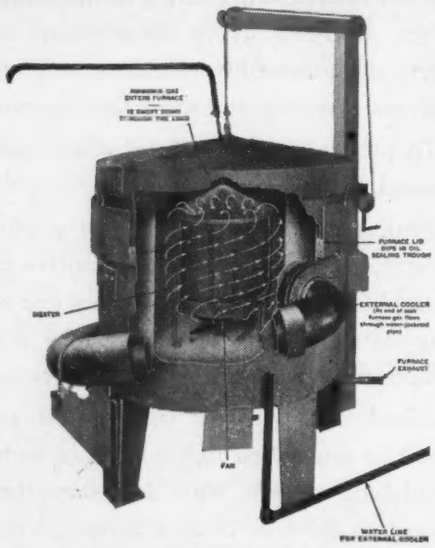
Right, nitriding the rotors by the Homo Method. One Homo Furnace is in background; top of another is in foreground. Girl loads the furnace basket, and man is noting some phase of operation on the equipment's Micromax Controller chart.

NITRIDING? Homo Method Does A Good Job For Pesco Products Co.

Nitriding of pump parts, as done in the Pesco Products plant, is a highly-precise operation, for hardening to a uniformity which definitely helps guarantee satisfactory performance of the completed airplane-pump mechanism.

Pesco accomplishes this result by making full use of the process controls which are the principal features of the Homo Method of Nitriding. Forced-convection of the hot ammonia circulates it evenly, so that each piece in the load develops the same hardness, at the same rate. The effective strength of the gas (its dissociation) can be checked at any time. All during the long heating cycle, the equipment's Micromax Control Pyrometer catches the temperature changes while they're tiny, and corrects them quickly and accurately, so that temperature is held in a practically straight line. And when nitriding is finished, the charge is cooled quickly and evenly, with a clean silvery matte surface of intense hardness and great uniformity.

If you wish further information, see or write for Catalog T-624.



The characteristic Homo swirl, shown by arrows, keeps fresh, uniformly heated ammonia going through the work space; assures uniform nitriding. Big spiral pipe is external cooler.

LEEDS & NORTHRUP COMPANY, 4957 STENTON AVENUE, PHILADELPHIA 44, PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS • TELEMETERS • AUTOMATIC CONTROLS • HEAT-TREATING FURNACES

Jrl Ad T-624(4)

ARMY NAVY *depends on me!*

A Slogan For Every American

"Get your scrap and ingots ready . . . Plymouth Will Haul 'em . . . and keep doing it". . .

No rushing the "hi-line" . . . lifts the tonnage and controls it at any speed, especially in going onto the open hearth floor. Makes safer, easier coupling . . . faster stopping and starting on stock house scales . . . highest clearance above rails—a definite advantage in the stock-house.

Tough? Six months . . . 'round the clock every day, and only THREE hours out during the whole time for repairs, other than refueling and lubrication. Isn't that what you want on the open hearth? That's the record of one of these babies. Write for complete information.

PLYMOUTH GASOLINE and DIESEL LOCOMOTIVES

PLYMOUTH LOCOMOTIVE WORKS

Division of The Fate-Root-Heath Co. PLYMOUTH, OHIO, U. S. A.

important

MESSAGE TO ALL MANUFACTURERS AUTHORIZED TO MAKE CIVILIAN GOODS REQUIRING WELDED STEEL TUBING...

We have facilities to fabricate ELECTRIC WELDED STEEL TUBING in all standard and many special sizes. We are prepared to give you the same service for your essential civilian requirements that we have rendered—and are continuing to render — to producers of war materials. For complete information write, wire or telephone...

SIZE AND THICKNESS CHART

TUBE DIAMETER	MAXIMUM WALL		MINIMUM WALL	
*O.D. SIZE	DECIMAL	GAUGE	DECIMAL	B.W. GAUGE
1/4"	.065"	16	.028"	22
3/8"	.065"	16	.028"	22
1/2"	.065"	16	.028"	22
5/8"	.065"	16	.028"	22
3/4"	.065"	16	.028"	22
7/8"	.095"	13	.028"	22
1"	.083"	14	.028"	22
1-1/8"	.095"	13	.028"	22
1-1/4"	.095"	13	.028"	22
1-3/8"	.109"	12	.035"	20
1-1/2"	.120"	11	.035"	20
1-5/8"	.120"	11	.035"	20
1-3/4"	.120"	11	.035"	20
1-7/8"	.165"	8	.035"	20
2"	.180"	7	.035"	20
2-1/4"	.203"	6	.035"	20
2-1/2"	.203"	6	.049"	18
2-3/4"	.220"	5	.049"	18
3"	.238"	5	.065"	16
3-1/4"	.238"	4	.065"	16
3-1/2"	.250"	4	.065"	16
3-3/4"	.250"	3	.065"	16
4"	.250"	3	.083"	14
4-1/4"	.134"	10	.083"	14
4-1/2"				
5-1/2"				

*Intermediate sizes within the range indicated can also be manufactured. Please consult us for sizes not listed.

THE STANDARD TUBE CO.

Detroit 3, Michigan

Welded Tubing — Steel Forgings

★ Complete Tube Stocks Maintained by: ★

STANDARD TUBE SALES CORP., One Admiral Ave., Maspeth, L. I., N.Y.
LAPHAM-HICKEY COMPANY, 3532 W. 47th Place, Chicago 32, Ill.
UNION HARDWARE & METAL CO., 411 S. First St., Los Angeles 54, Cal.

EVERY JOB IS *Smooth sailing* WHEN YOU USE

CHAMPION

WELDING ELECTRODES

★ CHAMPION electrodes have what it takes to do non-position, flat and fillet welding quickly and with minimum effort. Many veteran welders know from experience that they can depend upon CHAMPIONS for quality, uniformity and all round satisfaction. During the year 1945 you can make no better choice than CHAMPION electrodes for they are all the name implies.

THE CHAMPION RIVET CO.

11200 HARVARD AVE., CLEVELAND, OHIO

EAST CHICAGO, IND.

Fifteen of the Leading Steel Makers in this Country and Canada use the MO-MAX *Formula in producing their Trademarked Brands of High Speed Cutting Tool Steel... and*

"LMW"	Allegheny Ludlum Steel Corp.
"Mohican"	Atlas Steels, Ltd.
"Bethlehem HM"	Bethlehem Steel Company
"Mo-Cut"	Braeburn Alloy Steel Corp.
"Star Max"	The Carpenter Steel Co.
"Molite 8"	Columbia Tool Steel Company
"Rex-T-Mo"	Crucible Steel Co. of America
"Di-Mol"	Henry Disston & Sons, Inc.
"Rex-T-Mo"	Halcomb Steel Co.
"Mogul"	Jessop Steel Company
"Tatmo"	Latrobe Electric Steel Co.
"S. T. M."	Simonds Saw and Steel Co.
"Mo-Tung"	Universal-Cyclops Steel Corp.
"8-N-2"	Vanadium-Alloys Steel Co.
"Vul-Mo"	Vulcan Crucible Steel Co.

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TRADE MARK REG. U.S. PAT. OFF.

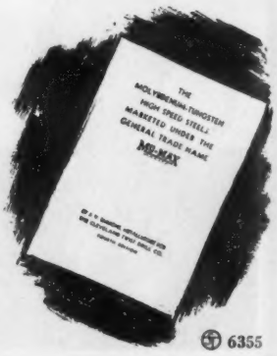
HIGH SPEED STEEL

MO-MAX Molybdenum-tungsten high-speed steel was the first commercially successful Moly High Speed steel. Through eleven years of service, it has proved to be highly efficient, surpassing the old standard 18-4-1 High Speed Steel. Twenty thousand tests show 20% more work per grind and per tool.

MO-MAX is easy to forge, anneal, weld, braze, harden and temper. Its long service life and efficiency make it economical from the standpoint of overhead cost.

A SCIENTIFIC STUDY

Into the 52 pages of this booklet, MO-MAX has crammed the history of the development of this molybdenum-tungsten steel. Interesting comparative photographs of the micro-structure of MO-MAX and 18-4-1 steel, and graphic charts, make it a valuable textbook on the subject. For your copy of this booklet, write to THE CLEVELAND TWIST DRILL CO., 1242 East 49th St., Cleveland 14, Ohio.



6355

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War's demands still call for all the output of the NORMA-HOFFMANN factory. But, already, far-sighted manufacturers are working with NORMA-HOFFMANN engineers on their designs for new and better peace-time products equipped with PRECISION BEARINGS.

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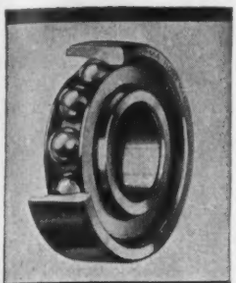
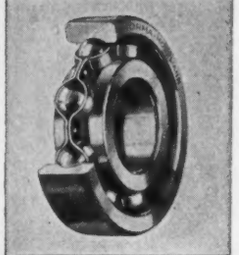
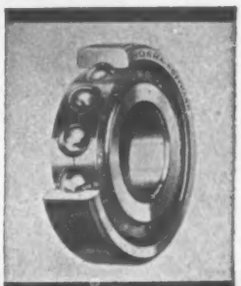


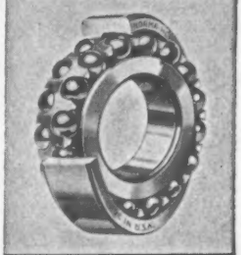
Separable (Magneto) Ball Bearing



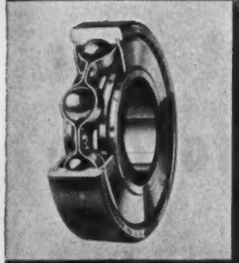
Single Row Ball Bearing



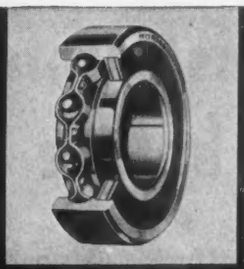
Litro ("CL") Composition Retainer Ball Bearing



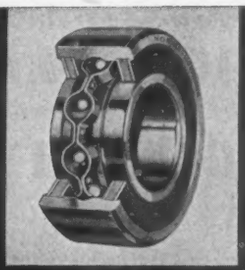
Double Row Self-Aligning Ball Bearing



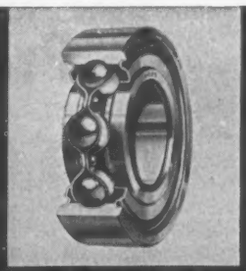
Shielded Type Single Row Ball Bearing



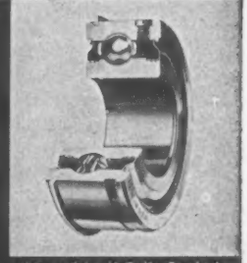
Single Felt Seal Ball Bearing



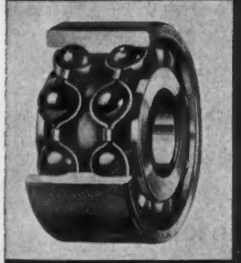
Double Felt Seal Ball Bearing



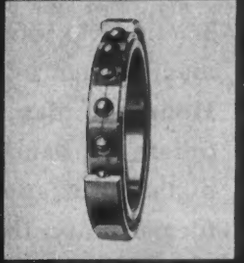
9000 Series (Feltless) Sealed Ball Bearing



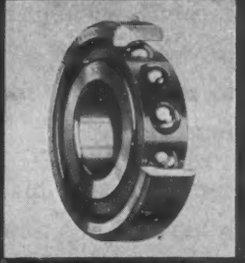
"Cartridge" Fully Sealed, Refillable Type Ball Bearing



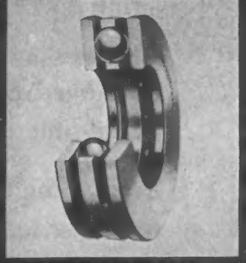
Double Row Ball Bearing



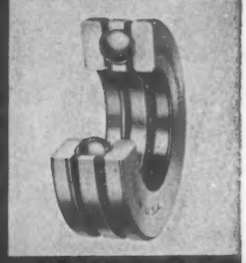
Extra Light Type Ball Bearing



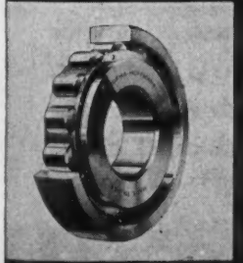
Angular Contact Ball Bearing



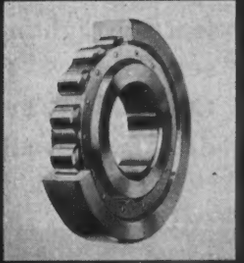
Extra Light Single Direction Ball Thrust Bearing



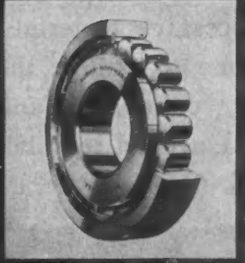
Single Direction Ball Thrust Bearing



Standard Cylindrical Roller Bearing

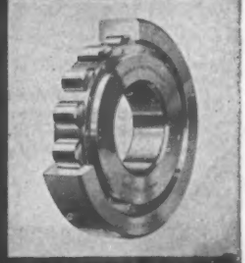


Type "E" Cylindrical Roller Bearing



Full Type (Retainerless) Cylindrical Roller Bearing

Extra Light Cylindrical Roller Bearing



Two-Lipped Cylindrical Roller Bearing

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RIGHT NOW!

...Prepare to rust-protect your war machinery before storage

FREE—This pocket-size digest of the principal corrosion preventive "specs" for which Houghton supplies approved products.

Either government-owned equipment or your own war machines will have to be carefully protected against corrosion before they can be moved out to make room for peace-time manufacturing.

Even though that great day may not have actually arrived, it's time to prepare for it, *right now,* so you will not have a last-minute shortage of the necessary materials. It will take time to collect the lumber, paper, containers and rust preventives needed to fulfill Uncle Sam's published packaging instructions.

That's a big job—one that will be made easier by a talk with the Houghton Man, who knows how others are handling it, preferred methods of application, and information on the various preventives we supply to meet these specifications. Our 70-year experience in fighting rust is at your service. E. F. HOUGHTON & CO., 303 W. Lehigh Ave., Philadelphia, and all principal cities.

Houghton's RUST Preventives

A BEND CAN'T BALK THE JOB

OSTER

no. 300 line

GENERAL PURPOSE THREADING MACHINES

Note the open type vise and revolving die-head which makes bent pipe as easy to thread as straight pipe on the Oster No. 300 Series machines.

No complicated, costly changes of equipment are needed to thread a wide variety of work including long, short, straight, bent pipe, nipples, rods, studs, and bolts.

Lever-operated die-head gives full control of threading-dies. Quick and easy adjustment of chasers for shallow or deep threads is another advantage of the No. 300 Series Die-Head.

Built-in cut-off guides are adjustable for all sizes of pipe within range of each machine. A lathe-type cut-off tool ground with proper cutting angle and clearance cuts pipe off clean and square, leaving no burr. Cut-off tool is fed and oiled automatically and is easily removed for re-sharpening when required.

Three Sizes of "No. 300 Series" Machines

No. 302: Standard pipe range: 1/4" to 2". Extra pipe range: 1/8". Standard bolt range: 5/16" to 1 1/2". Extra bolt range: 3/8" to 1/2".

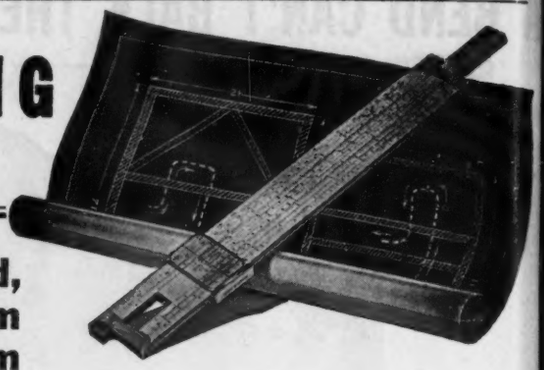
No. 304: Standard pipe range: 1" to 4". Extra pipe range: 1/2" and 3/4". Standard bolt range: 1 1/8" to 2". Extra bolt range: 3/4" to 1".

No. 326: Standard pipe range: 1 1/4" to 6". Extra pipe range: 1". Standard bolt range: 1 3/4" to 4". Extra bolt range: 1" to 1 5/8".

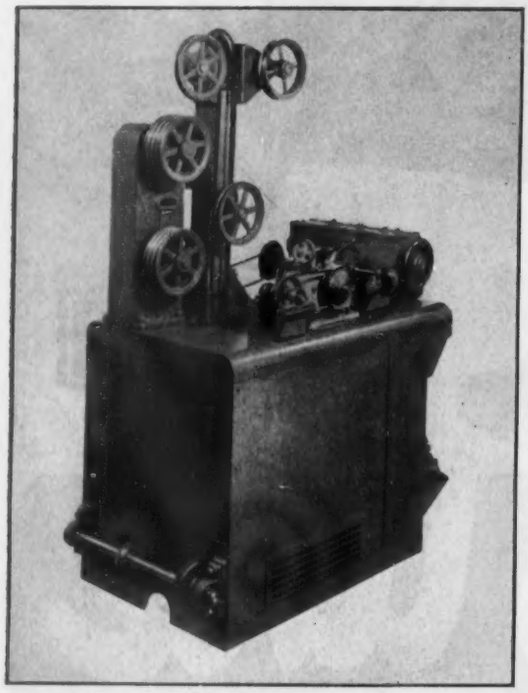
Write for illustrated catalog "LIST NO. 12-A"

THE OSTER MANUFACTURING COMPANY • 2037 EAST 61ST STREET, CLEVELAND 3, OHIO, U. S. A.

OVEN ENGINEERING NEWS



Speed Increased, Finish Improved, Attendant Labor Cut to Minimum By IOE Cable Lacquering System



IOE coating and impregnating systems for wire, cable and allied products have brought about a decided improvement in the standards of the industry. They are now operating in leading plants throughout the United States, producing beautifully finished wire at speeds from 3 to 5 times faster than those of previous equipment. Not only surface finish but dielectric strength and cross-sectional accuracy are distinctly superior.

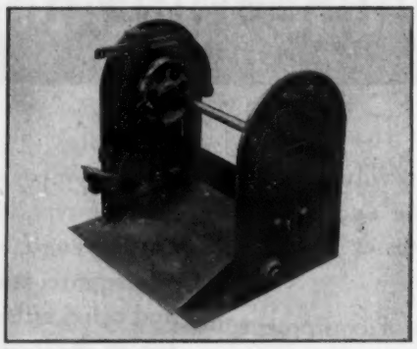
Each **IOE** unit is compact and easy to operate, with readily accessible lacquer and saturation pots, quickly changed unwind stands and high-speed constant-tension takeup machines. Result: under normal conditions ***one man can handle an 8-end system producing 48,000 lineal feet of medium size cable per hour!***

Takeup Units

These high-speed constant-tension takeups (left), complete and self-contained, are made in standard sizes with a wide range of speed and tension. Their adjustable wire lay gives them extreme flexibility, and they are adaptable for many different materials.

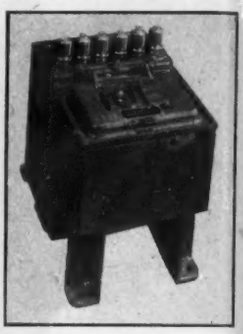
Payoff Stands

The payoff stands (below) are equally efficient, affording controlled tension at all times and thereby eliminating backlash. They are foot-pedal loaded, the operator simply rolling the reel into position and stepping on a foot pedal which simultaneously raises the reel and sets a counterweighted tension brake.



Lacquer Pots

IOE lacquer pots are designed for single or multi-pass lacquering, and are furnished in single-pass, standard for saturation, and 5- and 6-pass, standard for lacquering. They are made of cast aluminum or iron in three standard sizes, equipped with optional pressure feed, lower seal control and wiper control. Their use assures 100 percent coverage of braid, while positive wiping eliminates excess lacquer coating.



Saturation Pots

Saturation pots of remarkably advanced design are included in all **IOE** systems. These are supplied for any number of immersions from 3 to 25, hold thin saturants, and are equipped for pressure feed and quick draining. They are completely accessible and easily threadable.

Drying Tower

The principal unit of the system is a highly efficient explosion-proof vertical oven, designed to produce an extremely high gloss finish with absolute safety. It can be heated by electricity, gas, oil or steam, and maximum recirculation of atmospheres is attained despite the extreme volatility of the impregnants and lacquers used. All such oven towers are completely accessible and are adapted to existing buildings without inconvenience to the user.

Note: IOE *lacquer systems are also applicable to finishing of coated cords, fishlines, tapes, coated filaments and fibres.*

GET COMPLETE DATA

This page gives only a bare outline of IOE cable lacquering equipment. For full information, send for a free copy of "Lacquering of Insulated Wire and Cable", a 16-page reprint of our authoritative article in "Wire and Wire Products"

(This is No. 16 of a series. Reprints of previous advertisements will be sent free upon request.)

IOE ENGINEERING VERSATILITY

THE INDUSTRIAL *Oven Engineering* COMPANY

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Cold bend to your exact specifications with a Wallace Bender . . . all ductile metals . . . tubing, solid bars, rolled moldings, extruded sections, structural shapes, pipe and conduit . . . at high-speed output for mass production of identical sections or at a custom rate where limited quantities of various bends are required . . . up to 16" diameter steel pipe or the equivalent in tubing or structural shapes.

Eighty-eight page manual-catalog giving complete details will be sent upon request.

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The number of years any concern has behind it means little if each of those years hasn't marked further progress and improvement of its products . . . Our relations with the Steel and Non-Ferrous Industries for the past three-quarters of a century give ample proof that we have made good use of this time.

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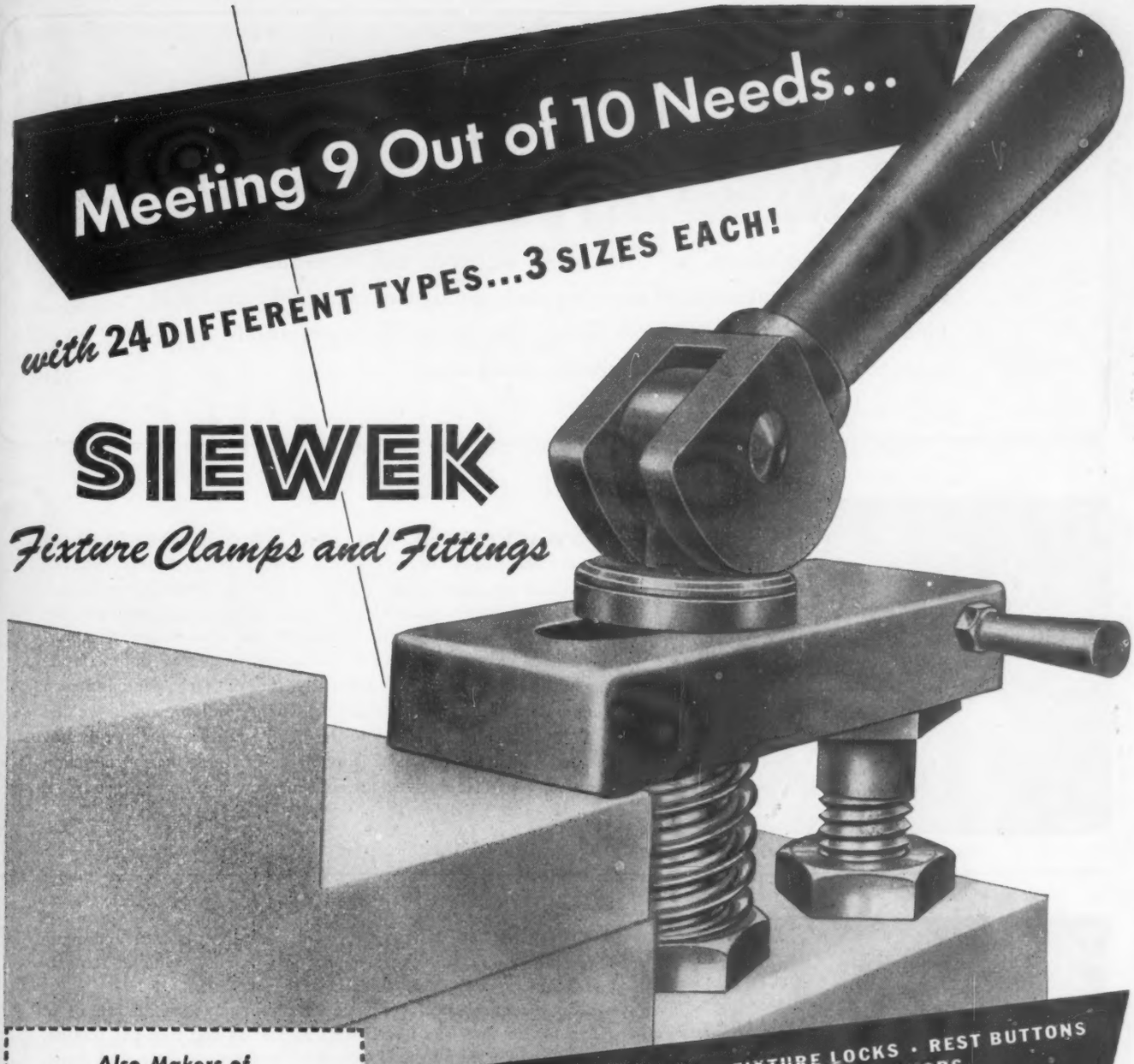

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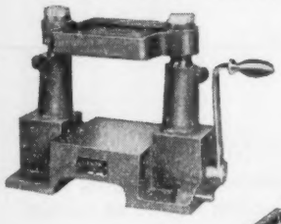

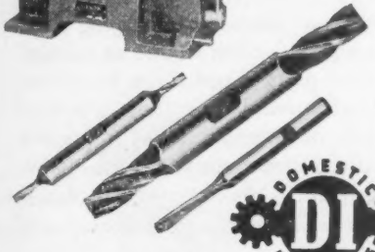

DOMESTIC INDUSTRIES DI

The needs of most jobs are met by the wide variety of types and sizes of Siewek Clamp Assemblies. Designed to reduce the time required to meet job conditions by 50% to 75%, these clamps need a minimum of details. *In fact, you can buy the complete clamp assembly for less than the cost of designing it on your drawing board!*

Siewek Clamps are strongly constructed to provide uniform right angle pressure for secure holding. All parts subject to strain are specially heat treated and hardened, to last for years with maximum safety.

Write today for full size template drawings to use in laying out work.

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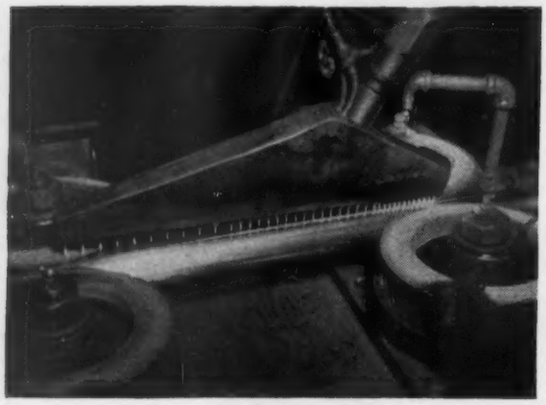
OF DOMESTIC INDUSTRIES, INC.

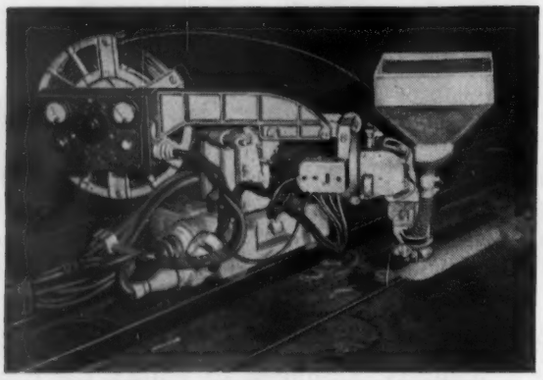
Detroit (Ferndale Station) Michigan • ***Distributors in Principal Cities***

LINDE'S METALWORKING METHODS
Help to Speed Production . . . Lower Costs

Savings of time, money, and materials in the production of metals and in the fabrication of metal products are being made throughout industry by the use of Linde-developed methods for the cutting, joining and treating of metals. Applications of some of these methods are illustrated here.



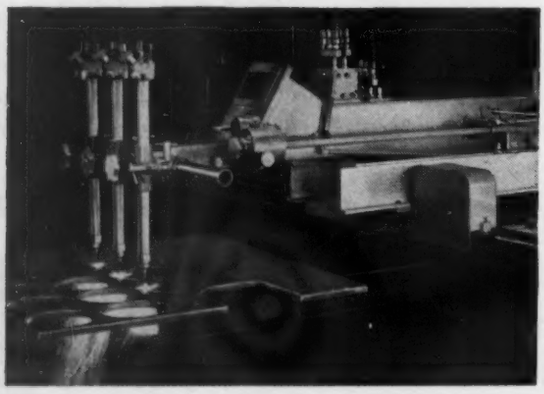
OXY-ACETYLENE WELDING — Tubing can be fabricated from steel strip moving at continuous high speeds through forming rolls and the edges joined automatically by oxy-acetylene flames. Cylindrical shapes such as barrels, drums, tanks, and cases also can be made rapidly by similar automatic and semi-automatic applications of oxy-acetylene welding. Eighteen-gage steel, for example, is being oxy-acetylene welded at the rate of 5 feet per minute on a simple and inexpensive machine. These developments in welded fabrication can be applied to the manufacture of many types of products. Linde equipment is available for these mass production operations and Linde's engineers can show you how to use it.



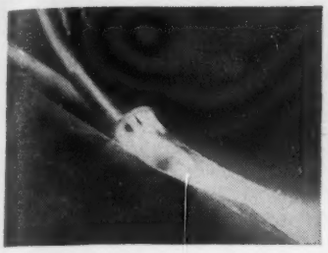
UNIONMELT WELDING — Linde's UNIONMELT automatic electric welding process, produces high-quality welds at remarkably high speeds—without flash, glare, or sparks.

Eighteen-gage steel, for example, can be joined at the rate of 12 feet per minute . . . 1-inch steel as fast as one foot per minute. Welds produced by the UNIONMELT process are clean and dense, strong and ductile. Full penetration and uniform quality are assured by automatic controls set by the operator.

UNIONMELT welding is widely used in the fabrication of such metal products as pressure vessels, shell cases, ships, tanks, truck wheels, and anchor chains. Linde can show you how you can use UNIONMELT.

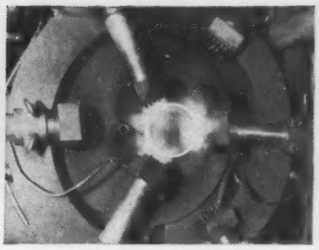


OXY-ACETYLENE FLAME-CUTTING — Oxy-Acetylene Flame-Cutting is a quick, "one-pass" method for shaping steel. Flame-cut edges are clean and smooth . . . often require no machining before use. Change-overs from parts of one shape to another require only a few minutes. Mechanized flame-cutting in several planes simultaneously is a quick and economical way to prepare plate edges for welding. In the illustration at the left, several blowpipes . . . guided by a single templet . . . are mounted on a flame-cutting machine to cut simultaneously. You can get this equipment from Linde and Linde can show you how to use it.



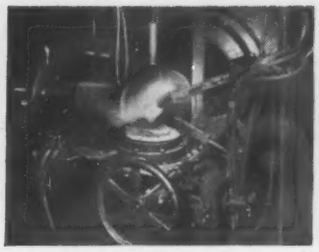
FLAME-GOUGING

With OXWELD blowpipes equipped with gouging nozzles, a groove of surface metal can be removed without harm to adjacent areas.



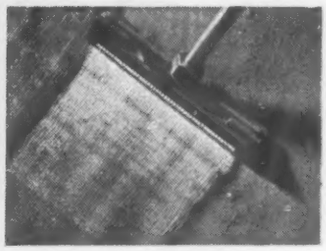
FLAME-HARDENING

Oxy-acetylene flames followed by a quench impart a hard, wear-resistant case to steel and iron parts without affecting the toughness of the core.



FLAME-SPINNING

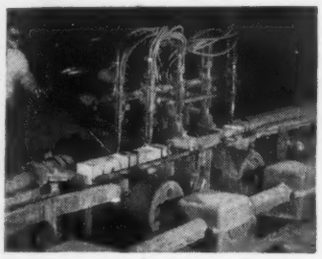
Tubing heated by oxy-acetylene flames while spun rapidly can be quickly end-formed to eliminate deep-drawing and other operations.



FLAME-PRIMING

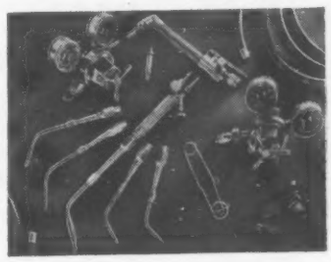
Oxy-acetylene flame - priming removes loose scale, rust, and surface moisture from steel to make paint go on faster, bond tighter, and last longer.

Apparatus and Supplies for Every Application of the Oxy-Acetylene Process



MACHINE APPARATUS

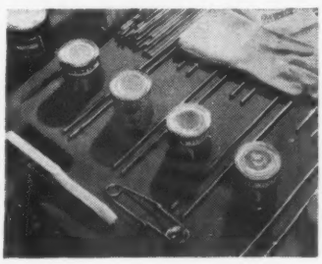
Included in the OXWELD line of apparatus are portable and stationary oxy-acetylene machines for cutting shapes or straight lines; flame-hardening apparatus; bar and billet cut-off machines; automatic welding equipment; and tractor units for plate-edge preparation.



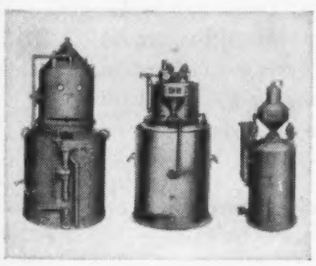
HAND APPARATUS

Oxy-acetylene apparatus which may be ordered from Linde includes oxy-acetylene blowpipes for all welding and heating work; oxy-acetylene cutting blowpipes, cutting attachments, and nozzles; oxy-acetylene descaling and flame-priming equipment. OXWELD apparatus is supplied from Linde offices and warehouses. The PUROX and PREST-O-WELD line, and PREST-O-LITE air-acetylene appliances for soldering and brazing, are distributed by industrial and automotive jobbers.

WELDING RODS AND SUPPLIES



The many kinds and sizes of OXWELD high quality welding rods make it possible to select the one that will give best results on each job. The OXWELD line also includes fluxes, gloves, goggles, lighters, hose, and asbestos paper. Rods and supplies may be ordered from Linde or from automotive and industrial jobbers.



GENERATORS AND MANIFOLDS

OXWELD acetylene generators have maximum generating capacities of from 30 to 9,000 cu. ft. per hour. OXWELD manifolds centralize oxygen and acetylene supply from cylinders.

OXYGEN, ACETYLENE, CARBIDE

A booklet describing use of LINDE oxygen, PREST-O-LITE acetylene, UNION carbide, and OXWELD apparatus in these and other processes will be sent without charge on request. Ask for Form 5268A.

BUY UNITED STATES WAR BONDS AND STAMPS

MARITIME "M" AWARD FOR OUTSTANDING PRODUCTION ACHIEVEMENT

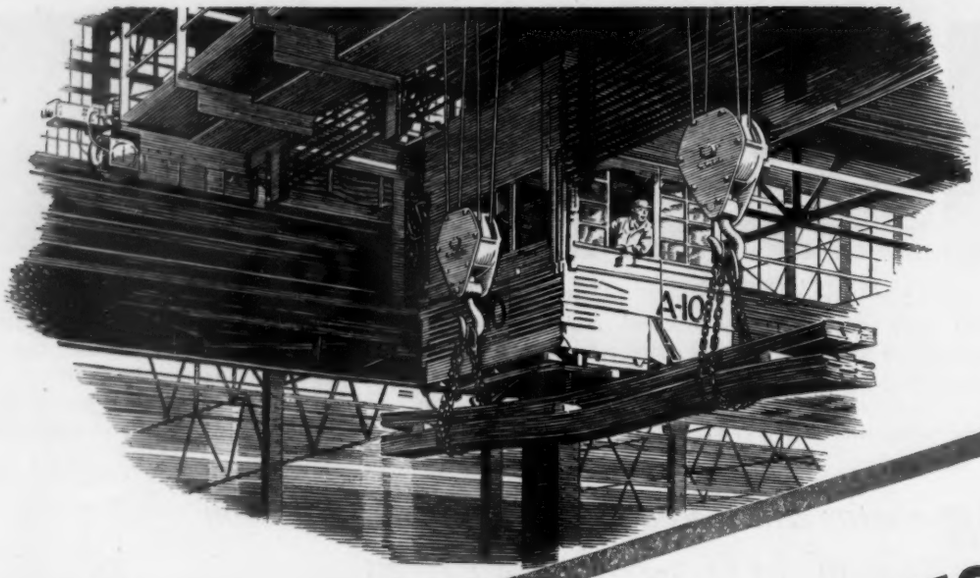
THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

30 E. 42nd St., New York 17, N. Y. UCC Offices in Other Principal Cities

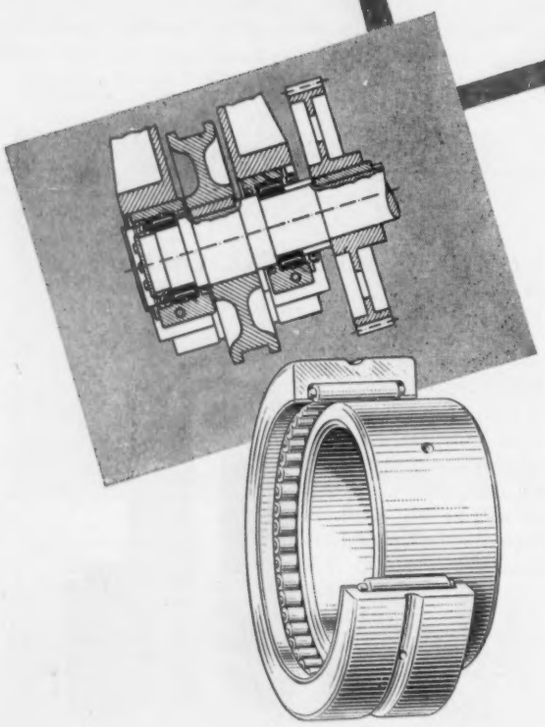
In Canada: Dominion Oxygen Company, Limited, Toronto

The words "Linde," "Prest-O-Lite," "Union," "Oxweld," "Purox," "Prest-O-Weld," "Haynes Stellite," and "Unionmelt" are trade-marks of Union Carbide and Carbon Corporation or its Units.



Drawing from photograph furnished by Carnegie-Illinois Steel Corporation

PUTTING TONS ON THE SPOT



Whether it's a lifting job that calls for the maneuverability and operating ease of a lift truck, or a multi-ton lift that demands the strength of a giant traveling crane—*putting tons on the spot* is done by effortless, finger-tip control, when loads travel on anti-friction Torrington Bearings.

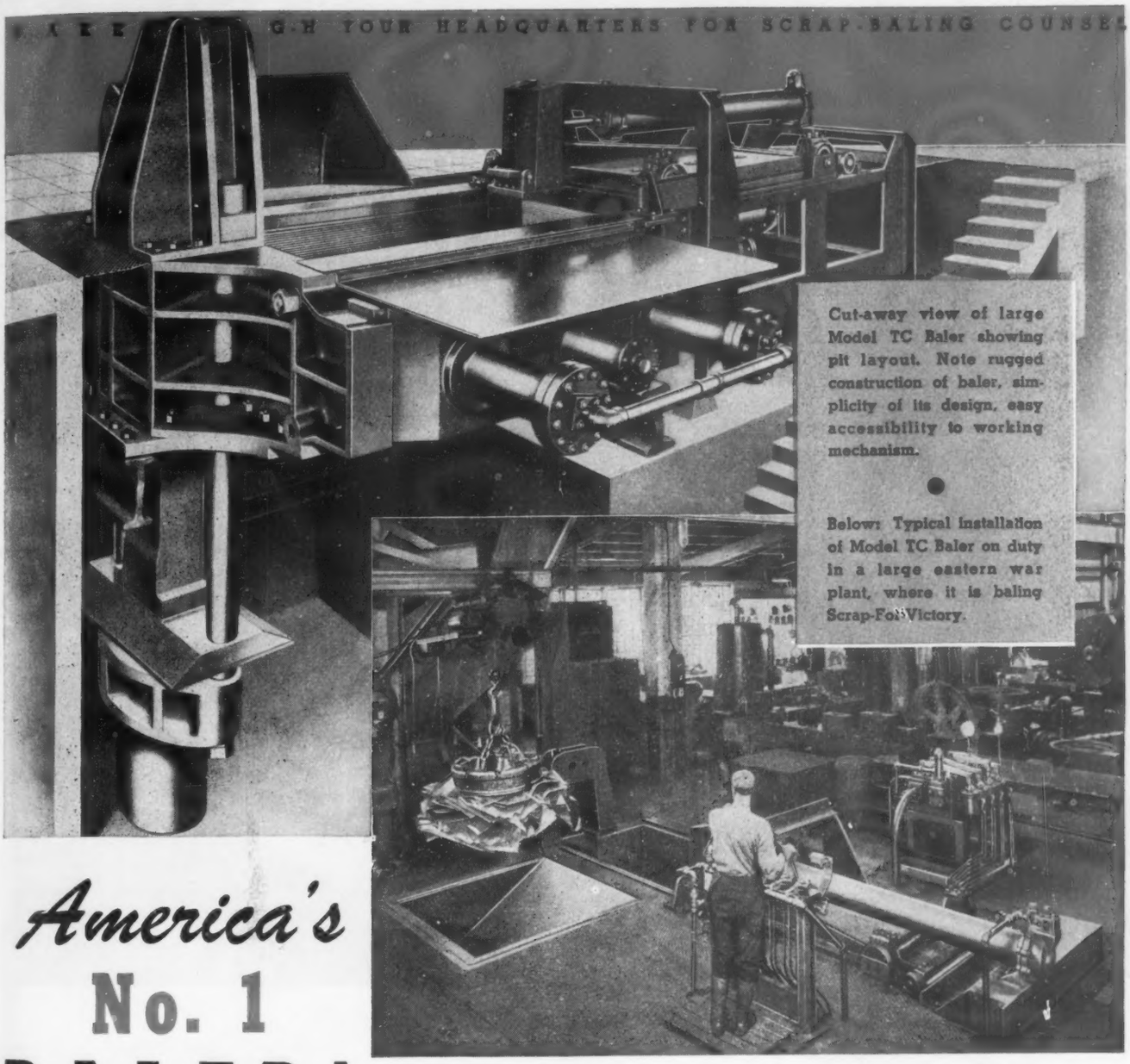
In the application illustrated, the high load capacity and compact design of the Torrington Type NCS Heavy-Duty Needle Bearings make them ideal for installation in the crane's axle housings.

Out of the ordinary bearing applications are an important part of the service of Torrington's Bantam Bearings Division. Whether you need counsel on standard or large, custom-built anti-friction bearings, consult our engineering staff.

THE TORRINGTON COMPANY · BANTAM BEARINGS DIVISION
SOUTH BEND 21, INDIANA

TORRINGTON BEARINGS

STRAIGHT ROLLER · TAPERED ROLLER · NEEDLE · BALL



Cut-away view of large Model TC Baler showing pit layout. Note rugged construction of baler, simplicity of its design, easy accessibility to working mechanism.

Below: Typical installation of Model TC Baler on duty in a large eastern war plant, where it is baling Scrap-For-Victory.

America's No. 1 BALER!

FOR METAL WORKING PLANTS, SHEET MILLS, SCRAP YARDS

The G-H Model TC Hydraulic Triple Compression Baler is especially designed for efficient, high volume baling of bulky sheet scrap such as large industrial stampings and clippings, sheet mill trimmings, old auto bodies, fenders, drums and scrap wire. Because of its exclusive baling cycle, it compresses bulky scrap speedily without preliminary cutting or preparation . . . produces compact, high density, mill-sized bales at extremely low cost.

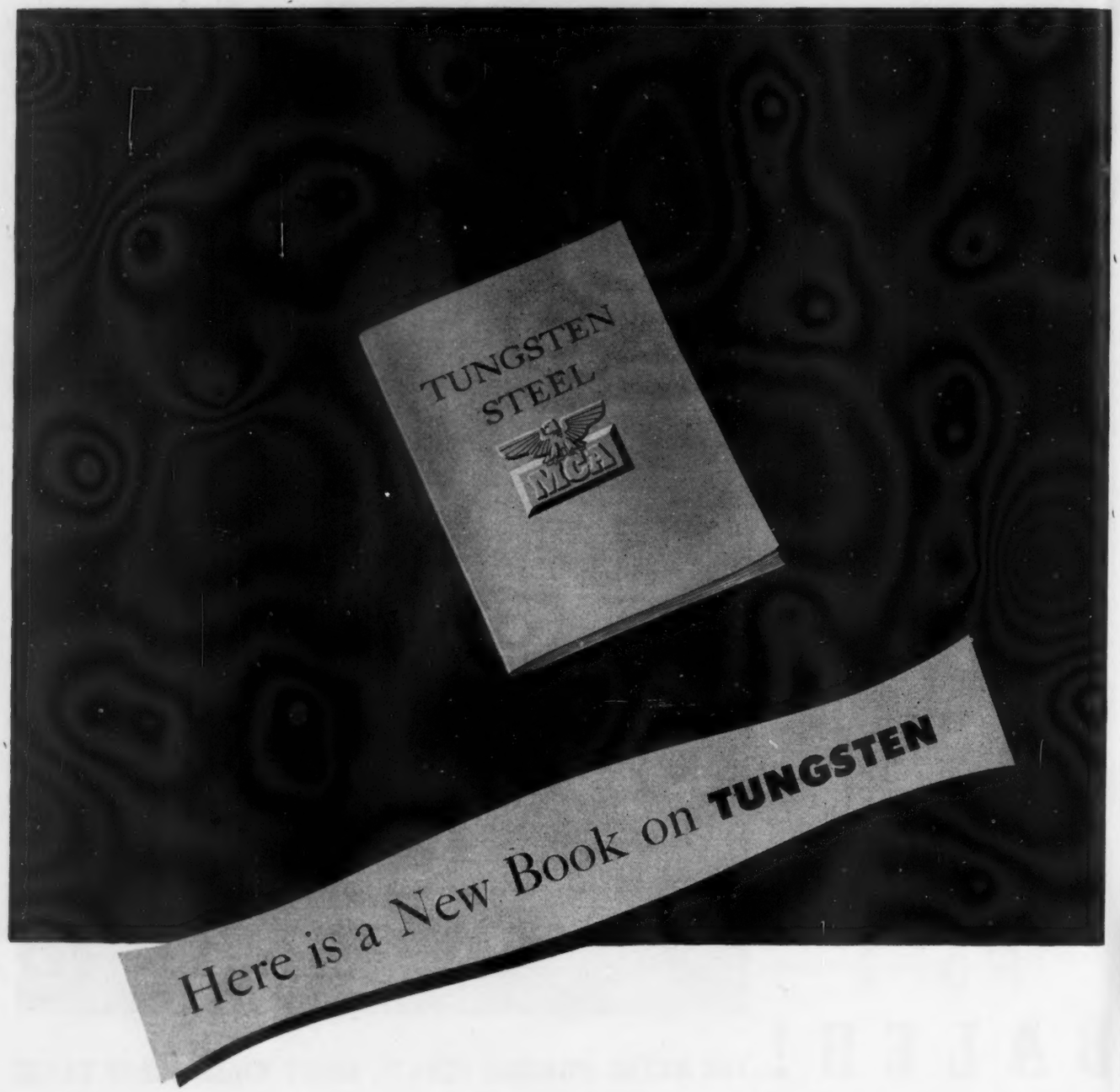
For further information on this powerful, skillfully engineered baling press, write for Bulletin 86-TC.

GALLAND-HENNING MFG. CO., 2747 S. 31st St., Milwaukee 7, Wis.

GALLAND-HENNING

SCRAP METAL BALING PRESSES

A 4611-1P-C



The nature and unique values of Tungsten being what they are, and knowledge of the metallurgical uses of Tungsten having recently advanced so much, the largest supplier of Tungsten to the metal-working industry has been prompted to bring out an authoritative treatise on the subject. The book here offered is believed to answer that description. Both scientific and practical considerations are dealt with, and procedures recommended, for best results. A copy of the book will be mailed on request. Correspondence is invited concerning any use of Molybdenum, Tungsten, or Boron.

AMERICAN Production, American Distribution, American Control—Completely Integrated.
Offices: Pittsburgh, New York, Chicago, Detroit, Los Angeles, San Francisco, Seattle.
Sales Representatives: Edgar L. Fink, Detroit; H. C. Donaldson & Co., Los Angeles, San Francisco, Seattle.
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MOLYBDENUM

CORPORATION OF AMERICA
GRANT BUILDING PITTSBURGH, PA.

MCA

DIAL TEST INDICATORS

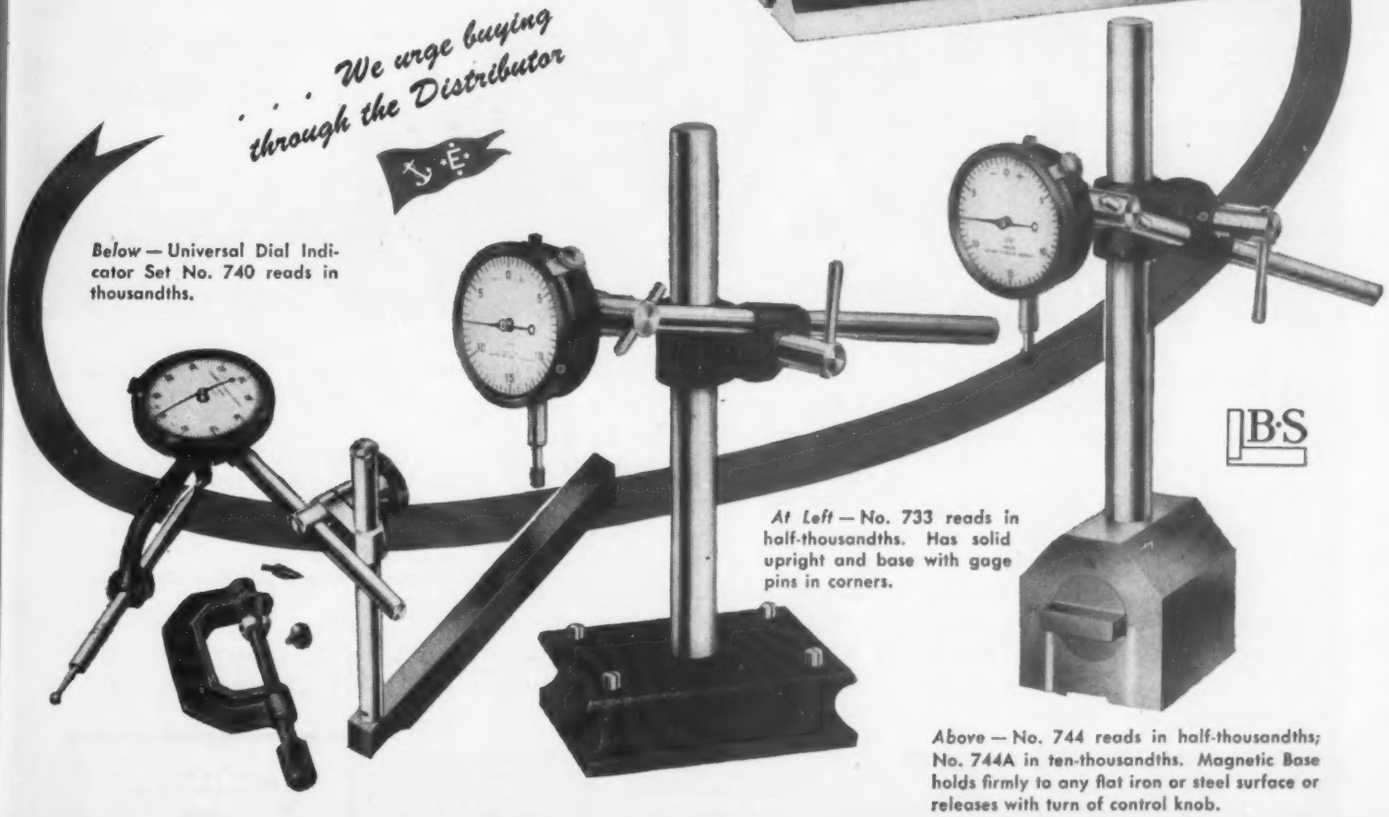
For Varied Requirements

At Right — No. 725 reads in thousandths; No. 725A in ten-thousandths. These small Dial Attachments are only 2¾" long, over-all.

These Dial Test Indicators have the conveniences of design and accuracy that characterize Brown & Sharpe Tools. Each is intended to give a long life of satisfactory, reliable service. Know the complete line of Brown & Sharpe Dial Test Indicators and Attachments shown in Catalog No. 34. Copy sent upon request. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

At Right — No. 731 reads in half-thousandths; No. 731A in ten-thousandths. Extremely rigid. Tubular construction. Individual clamp for each adjustment.
(No. 730, of lighter construction, reads in half-thousandths.)

. . . We urge buying through the Distributor



Below — Universal Dial Indicator Set No. 740 reads in thousandths.

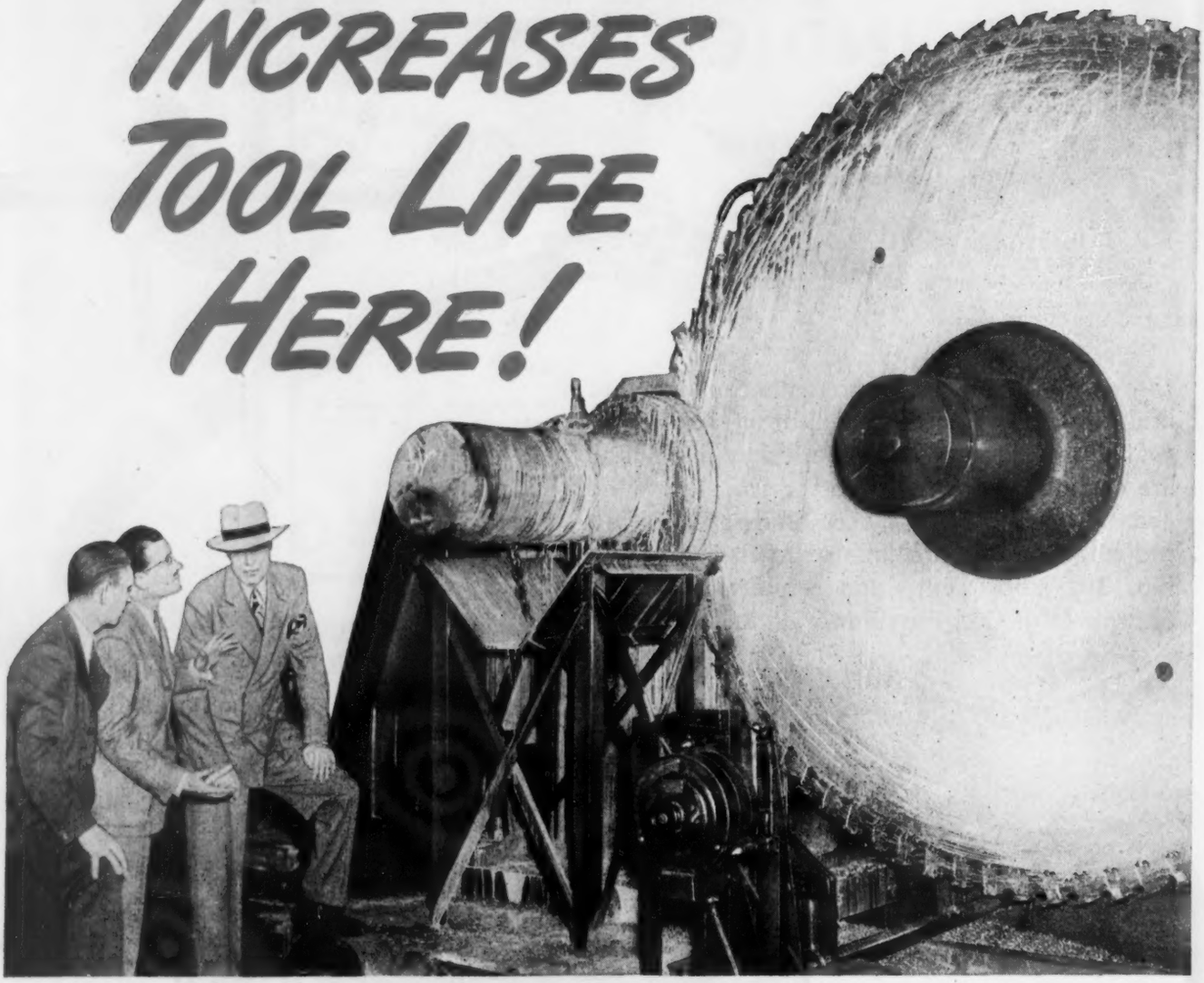
At Left — No. 733 reads in half-thousandths. Has solid upright and base with gage pins in corners.

Above — No. 744 reads in half-thousandths; No. 744A in ten-thousandths. Magnetic Base holds firmly to any flat iron or steel surface or releases with turn of control knob.

BROWN & SHARPE TOOLS

New S/V Solvac Oil 410...

INCREASES TOOL LIFE HERE!



HEAVY-DUTY cutting operations, such as this shaft-sawing job, impose tremendous pressures on cutting tools. The big problem for a cutting fluid is to protect the cutting edges from wear, chipping and breakage.

To meet this problem, Socony-Vacuum has developed a vastly improved non-gumming heavy-duty soluble oil. The new oil has been named S/V Solvac Oil 410.

This new oil, now in use in many shops, provides far greater pressure resistance and anti-weld properties than preceding heavy-duty oils. Yes, and these improvements were added without any sacrifice in lubricity characteristics.

The result is an ideal soluble oil for heavy-duty cutting. Ask your Socony-Vacuum representative for performance facts and figures on S/V Solvac Oil 410.

SOCONY-VACUUM OIL CO., INC.
Standard Oil of N. Y. Div. · White Star Div. · Lubrite Div. · Chicago Div. · White Eagle Div. · Wadhams Div. · Magnolia Petroleum Co. · General Petroleum Corporation of California.

CALL IN SOCONY-VACUUM FOR "CORRECT LUBRICATION"

Socony-Vacuum's FIVE STEPS to Lower Production Costs for You

1. Lubrication Study of Your Entire Plant
2. Lubrication Schedules and Controls
3. Lubricant Storage and Handling System
4. Skilled Engineering Counsel
5. Progress Reports of Benefits Secured

GARGOYLE Lubricants

SLEEVE TYPE BEARINGS *for* Every Type of Industry

For the New Product

One sure way to make a sales leader out of your new product is to build real performance into it. The best way of securing performance is to select the *correct* bearing for each application. The easiest way to select the right bearing is to consult with Johnson Bronze.

We are particularly well fitted to assist you. As we manufacture all types of sleeve-bearings . . . cast bronze . . . babbitt lined . . . sheet metal . . . powdered bronze, we hold no prejudice for any *one* kind. All of our experience, our facilities and our research for more than thirty-five years have been devoted to producing better bearings.

Why not call in a Johnson Engineer now? Permit him to review your applications . . . to make recommendations based on your operating requirements. There is one located near you. There is no obligation.

For Maintenance

The operating schedules of practically all machines during the past five years have been terrific . . . without parallel in our industrial history. Yet most manufacturers believe that the schedules for the postwar period will be even greater. How is your equipment going to meet this demand?

The first thing to check is the bearings. No doubt a good many will have to be replaced. When replacement is necessary —specify Johnson Bronze. We offer you the most complete line on the market . . . over 350 sizes of UNIVERSAL Bronze Bars . . . over 800 sizes of plain cast bronze bearings . . . 250 types of Electric Motor Bearings . . . babbitt and Ledaloyl, self-lubricating bearings. Every item in the line is the highest quality possible.

Call your local Johnson Bronze Distributor or write for Catalogue No. 410.

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COMES FIRST
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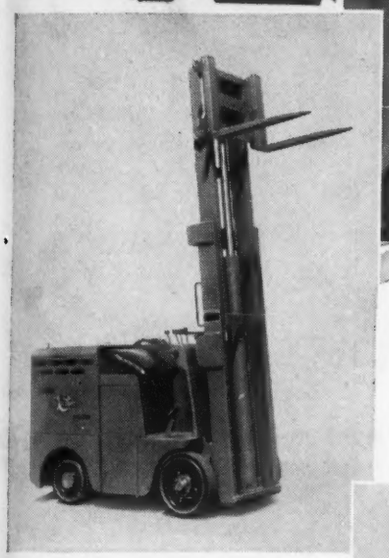
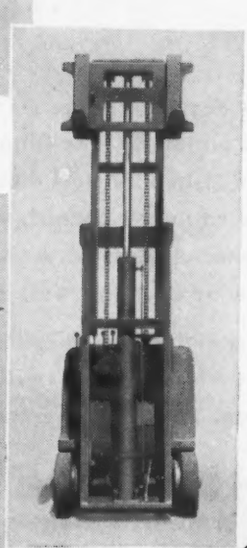
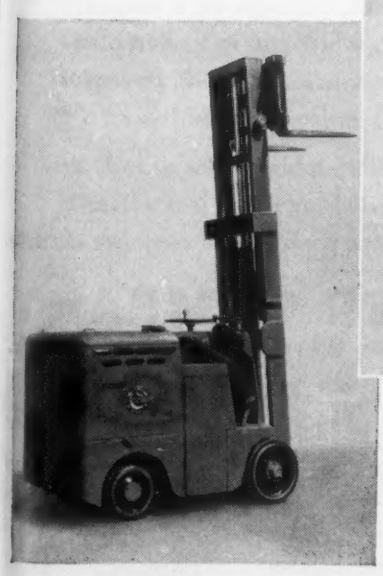
COMING







The New Crescent Electric

PALLETIER

For seven years, Crescent has been testing electric industrial fork truck design and construction features... sifting and weighing all possibilities in order to build not just another fork truck . . . but a truck offering advantages never before obtainable. The three models in the new Crescent Electric PALLETIER Line have been *pre-tested*... and they're on the way.

The Crescent PALLETIERS will handle at peak efficiency 95% of all fork truck requirements. Every modern feature has been incorporated . . . including those developed as the result of broad experience in wartime materials handling.

Current production demands and limitation orders make it impossible to offer the PALLETIER for immediate delivery. But all three models of this truck will be available just as soon as large scale industrial reconversion begins.

CRESCENT TRUCK COMPANY 1100 Willow St., Lebanon, Pa.

Crescent ELECTRIC TRUCKS and TRACTORS

Industrial Truck and Tractor Specialists for More Than 25 Years

Yoder AUTOMATIC FLYING CUT-OFF...

..A Versatile Production Machine

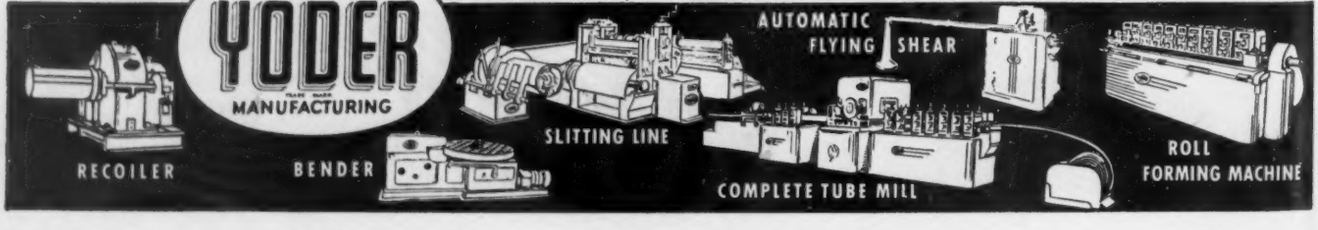
The Yoder Automatic Cut-off Machine is designed primarily to be used in connection with a roll-forming machine, for cutting formed sections on the fly. The forms it will cut, cleanly and accurately, are as varied as your needs. Cutting is accomplished by steel dies, mounted on a movable die-table, and actuated by crankshaft driven by compressed power springs, which are re-loaded automatically while the die-table is being returned to position for another cut. Accurate dies, swift, powerful strokes, assure smooth cuts to extremely accurate lengths, on even the most intricate section.

In addition, this machine may be productively used for straightening or cutting tubing, wire or rods or coil strip stock. It may be fitted with dies or punches for perforating and embossing . . . it is a versatile production machine capable of sustained earning operation. ***Let us send you a booklet with complete details.***

METAL • WORKING • PRODUCTION • MACHINERY

ENGINEERING YODER MANUFACTURING

THE YODER COMPANY
5502 Walworth Avenue, Cleveland 2, Ohio, U. S. A.



Exact Contour Hardening

in 2/3 of a SECOND with -MEGATHERM-*

ELECTRONIC HEAT

Here's another difficult hardening job, done simply and quickly with Megatherm.

Exact contour hardening of the inner gear of these supercharger clutch discs was done in less than ⅔ of a second each.

These gears were hardened to a depth of .050", with the hardening closely following the tooth and root contour of the gear surface, without affecting the strength or ductility of the remaining metal. The unretouched photograph above tells the story.

To do this contour hardening a jig was built to support the disc so that its inner surface surrounded a two-turn induction coil, directly connected to the output terminals of the 25 kw Megatherm.

The Megatherm automatic timer limits the heat period to exactly ⅔ of a second, then operates a solenoid which trips the disc into an oil-quench bath.

Here is another example of Megatherm's adaptability to many hardening problems involving irregular and "hard-to-get-at" surfaces.

If you have a surface hardening problem . . . whether for wartime or peacetime application . . . consult Federal's Megatherm engineers for the answer or write for complete data.

FEDERAL TELEPHONE & RADIO — FTR

Federal Telephone and Radio Corporation

*REG. AND PAT. TRADE MARK

INDUSTRIAL ELECTRONICS DIVISION

AN IT&T ASSOCIATE

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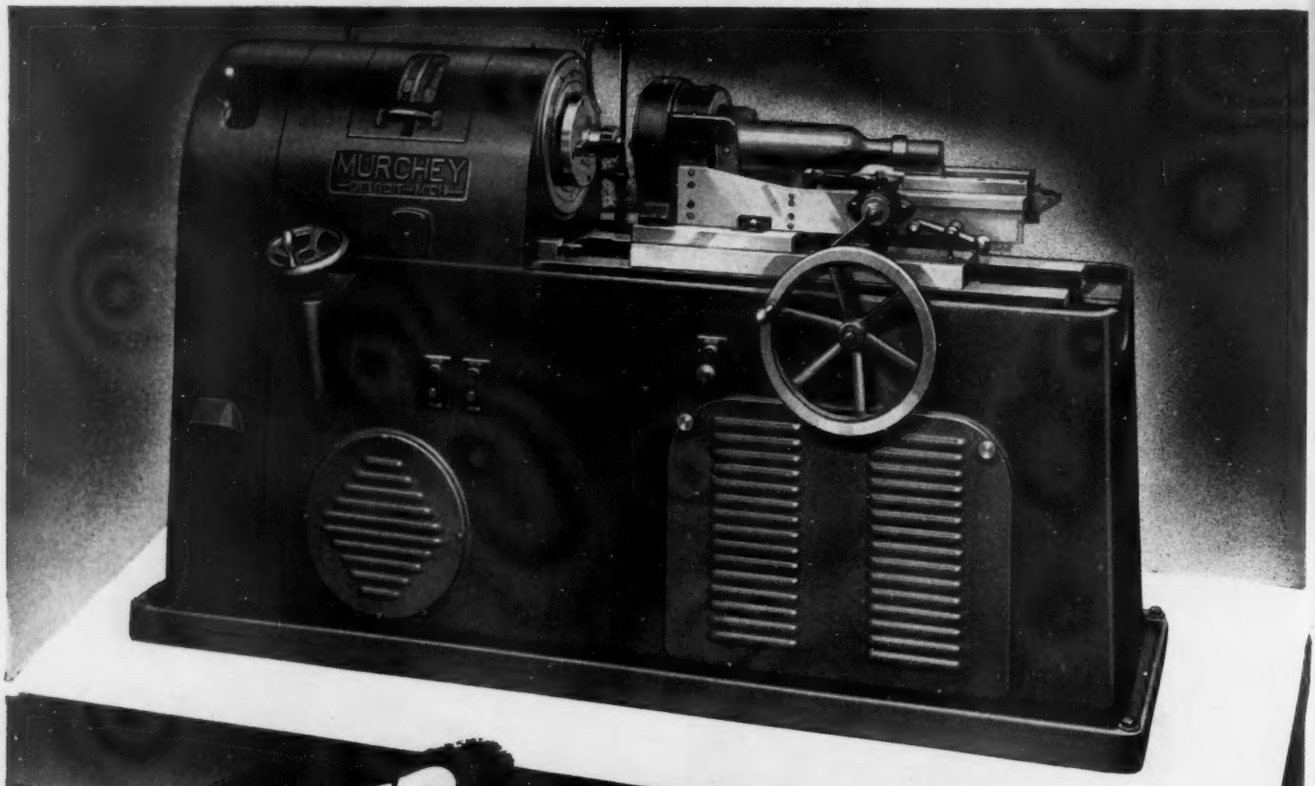

FOR FASTER, MORE ACCURATE THREADING that will keep YOU AHEAD of schedules—

Install a

MURCHEY

No. 32 THREAD MILLING MACHINE

Built and geared for mass production of right or left hand internal or external threads 1" in diameter up to 4" O.D. inclusive and up to 6" I.D. depending on the contour of the piece. 3" long up to ½" pitch and covering full length of thread through annular milling cutters. Completely hydraulic work cycle and a variable speed drive permits the selection of the right speed and feed for each job. Write for complete catalogue to Dept. S.

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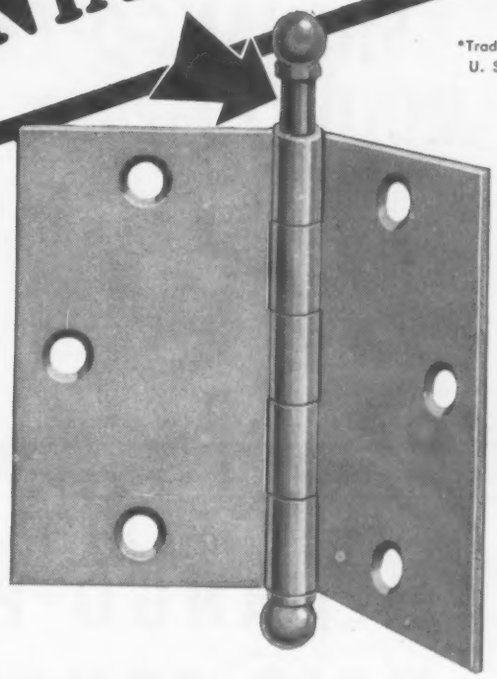
Murchey also manufactures all types of Collapsible Taps, Self Opening Die Heads and Shell Tapping Machines. Write for literature on any or all of these products.

MURCHEY

THERE'S A BIG DIFFERENCE IN SIZE . . . BUT BOTH ARE CONTINENTAL* WIRE

*Trademark registered U. S. Patent Office



THE WIRE OF A THOUSAND USES

The versatility of Continental wire is apparent when you look at the illustrations above. There is not only a big difference in the size of the wire in the match book and the pin in the door hinge, but there is a big difference in the temper, analysis, and finish. Continental wire for each of these applications is made especially to meet the individual requirements.

Continental specializes in producing wire in a vast variety of shapes, tempers, analyses, and coatings to fit the particular specifications of hundreds of products. You are invited to take advantage of this service. Write or wire today for complete information.

CONTINENTAL
STEEL CORPORATION
GENERAL OFFICES • KOKOMO, INDIANA

PRODUCERS OF: MANUFACTURER'S WIRE: Bright, Annealed, Galvanized, Coppered, Tinned, Liquor Finished, Lead Coated, Special wire, etc. Also Chain Link Fence, Nails, etc. STEEL SHEETS: Black, Galvanized, Hot Rolled Annealed, Hot Rolled Pickled, Long Terne, Copperior, Lead-Sealed, Galvannealed, Super-Metal, etc.

THE SUPERIOR SHEET STEEL COMPANY, *DIVISION* • CANTON, OHIO

THE SHENANGO FURNACE COMPANY

Lake Superior Iron Ores { Bessemer • Non-Bessemer / Aluminiferous

"Shenango" Pig Iron .. { Bessemer / Malleable — Basic / Foundry

SHENANGO-PENN MOLD COMPANY

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Centrifugally Cast

BRONZES • MONEL METAL • ALLOY IRONS

Rolls, Propeller Shaft Bearings, Bushings and Bearings

SHENANGO-PENN MOLD COMPANY

INGOT MOLDS AND STOOLS

Plants

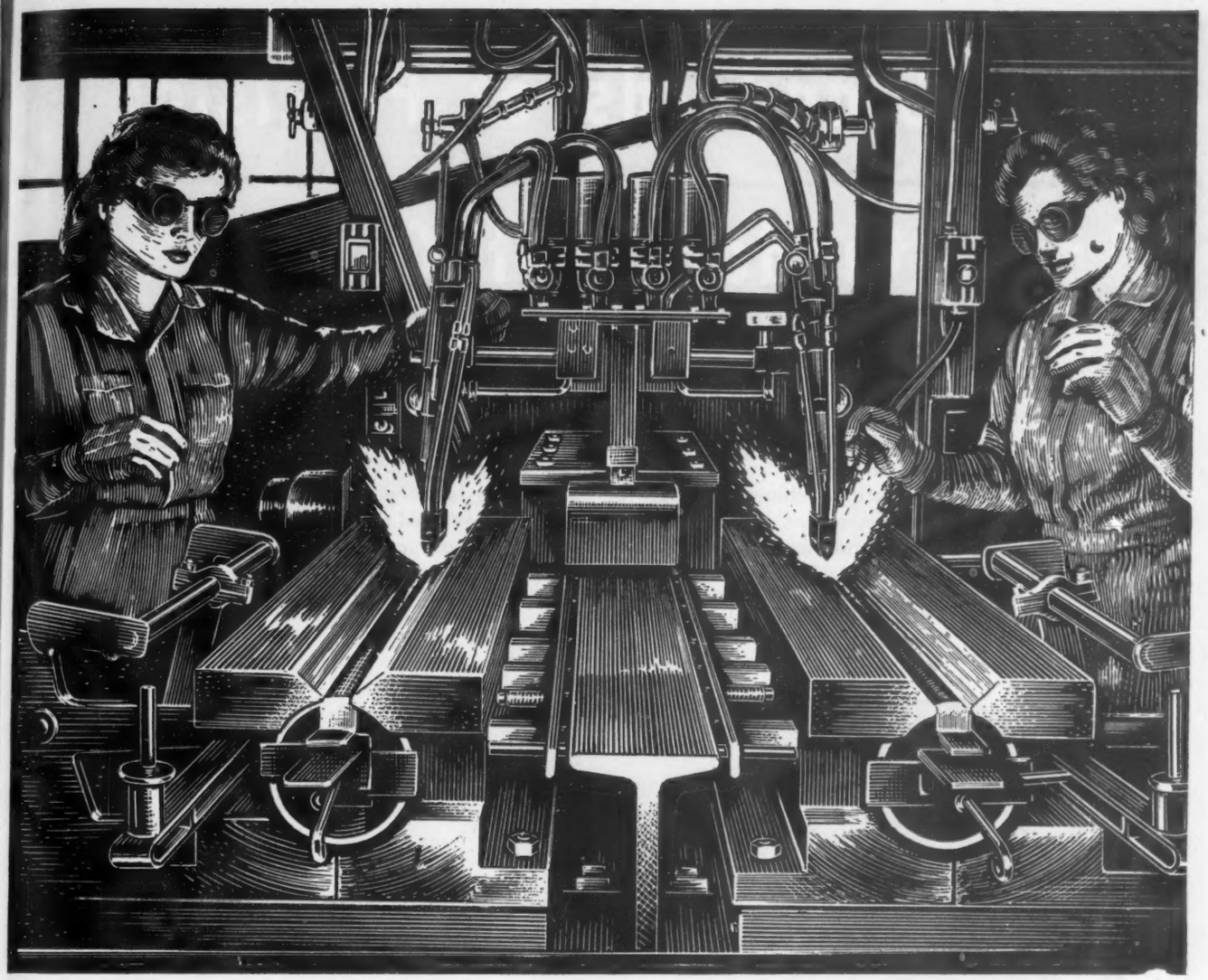
Sharpsville, Pa. • Pittsburg (Neville Island)

W. P. SNYDER & COMPANY

Established 1888

Iron Ore • Coal • Pig Iron • Coke

OLIVER BUILDING • PITTSBURGH



Courtesy Wheeling Steel Corporation

FLAME STITCHING COVERALLS FOR ARTILLERY SHELLS

SHELLS need protection against corrosion and other surface damage during their long journey to our global firing lines. Each shell is encased in a metal container—a "coverall" that preserves the lethal traveler on the long trip from arsenal to artillery post.

Automatic oxyacetylene flame welding machines perform the main tailoring operation in producing these metal shell-containers. Open seam tubes that have been formed from flat metal sheets are placed into each of ten identical welding machines, two of which are shown above. Then at the push of a button, all ten torches move as one, automatically stitching up the open seams. The operation takes only a minute . . . and the seams are tight and permanent.

This mechanical welding operation—developed in wartime by Airco Engineers—presents interesting opportunities for postwar manufacturing. It combines unusual speed with a high degree of weld uniformity, features that make for increased economy and reduced rejects.

Air Reduction's Applied Engineering Division will be glad to provide complete details on mechanical gas welding and other work-speeding flame and arc methods. For further information, or technical aid in using these modern methods, write to Dept. BW, at the New York office.

★ BUY UNITED STATES WAR BONDS ★

AIRCO

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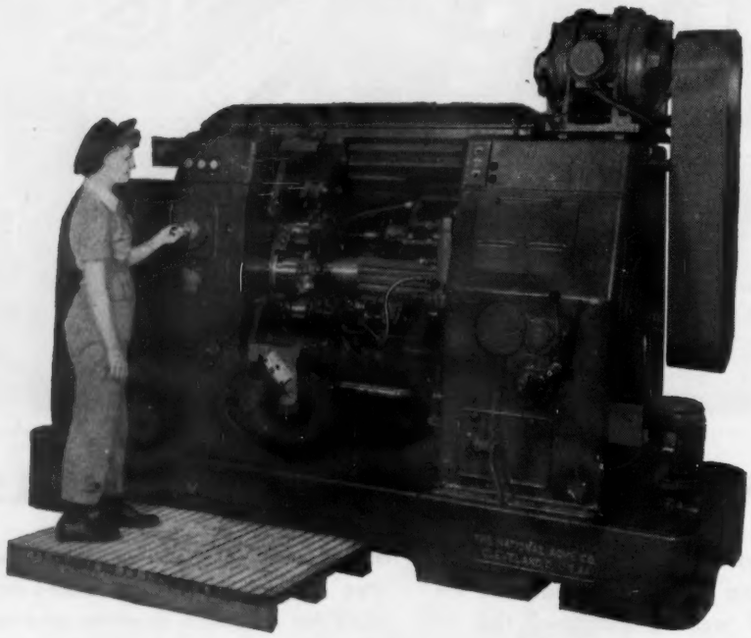
High Standards of Precision
Low Standards of Cost...

Here at National Acme, our main business is helping other manufacturers cut the cost of their products and at the same time raise their standards of precision.

We build Automatic machines that turn out *more* for *less*—machines that produce identical parts by the million—to whatever precision standards the job calls for.

These are the machines upon which industry can depend to build the improved products of the future. And to build them at costs that permit the lower selling prices needed to broaden markets.

You are invited to consult with us on how to increase production of metal parts, or how to cut their cost.

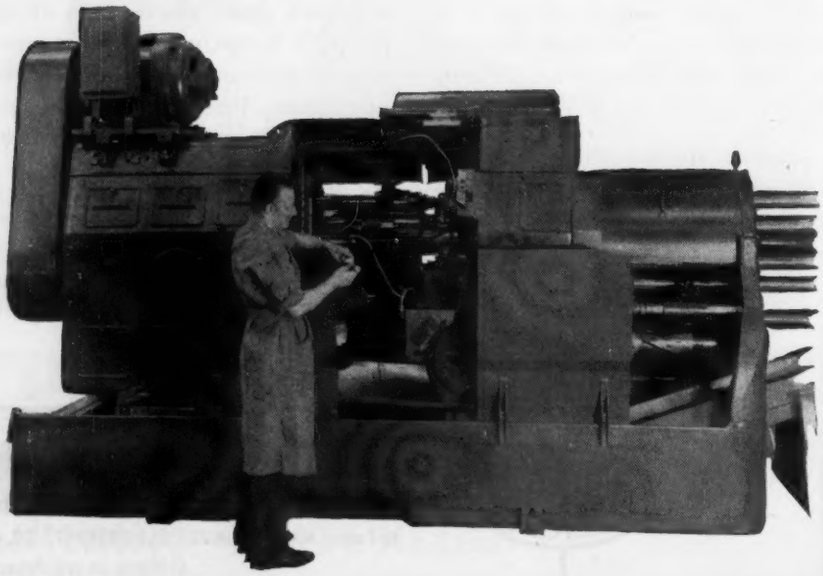


4-6-8
Spindle
ACME-GRIDLEY
Chucking Automatics

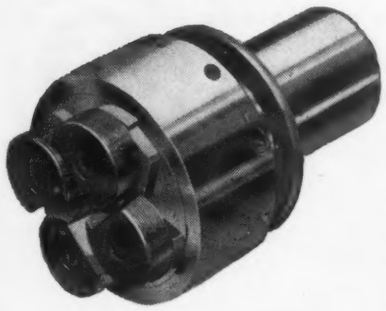
This new line of chuckers is built for fast operation and precision work. Chuck capacity up to 12". Easily accessible tooling area speeds setup and permits use of more tools per job—either high-speed steel or carbide-tipped.

4-6-8
Spindle
ACME-GRIDLEY
Bar Automatics

Built to handle bar stock from 9/16" to 7 1/4" diameter. Operate to highest precision standards at speeds and feeds limited only by the endurance of the tools. These machines have no equal for adaptability, for output per hour, or for low cost per piece.

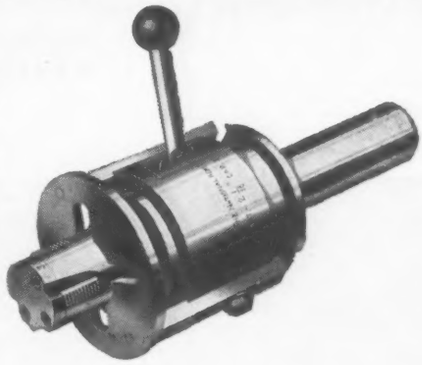


Both Automatic!



DIES AND TAPS

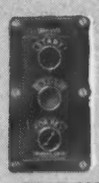
Namco Dies and Taps are specially built for long run, precision automatic operation, either rotating or stationary. Namco circular ground thread chasers may be reground through 270° circumference and last 10 to 50 times longer than other thread cutting tools. Wide range of types and sizes.



ELECTRICAL EQUIPMENT

LIMIT SWITCHES

Snap-Locks are built for extra long life, dependable and safe operation.

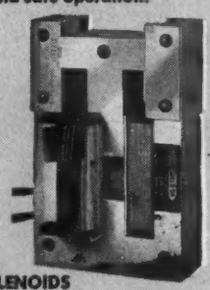


STATION CONTROL SWITCHES

Completely dependable. Engineered for your job—box or flush-type mounting.

MOTOR STARTER SWITCHES

Snap-Lock design protects against wear or failure.

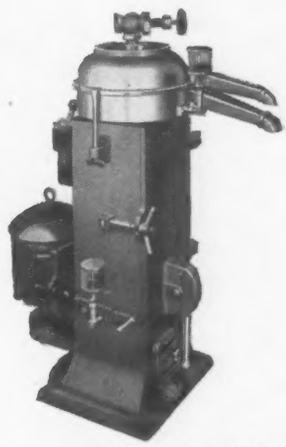


SOLENOIDS

For automatic push or pull action. 4 to 35 pounds. "Stellite"-Weld protection against plunger "mushrooming".

THE CHRONOLOG

Shows when, why and how long equipment is idle, and records units produced.



CENTRIFUGES

For cleaning and reconditioning of Lubricants and Coolants. Cut oil costs, add to tool life and protect finish of the product. Do not require a skilled operator. Built to machine tool standards throughout.

SEND FOR CATALOG

You are invited to send for Catalogs on Bar and Chucking Automatics, Dies and Taps, Electrical Equipment and Centrifuges. Please write on your company letterhead.

THE NATIONAL ACME CO.

170 EAST 131ST STREET • CLEVELAND 8, OHIO

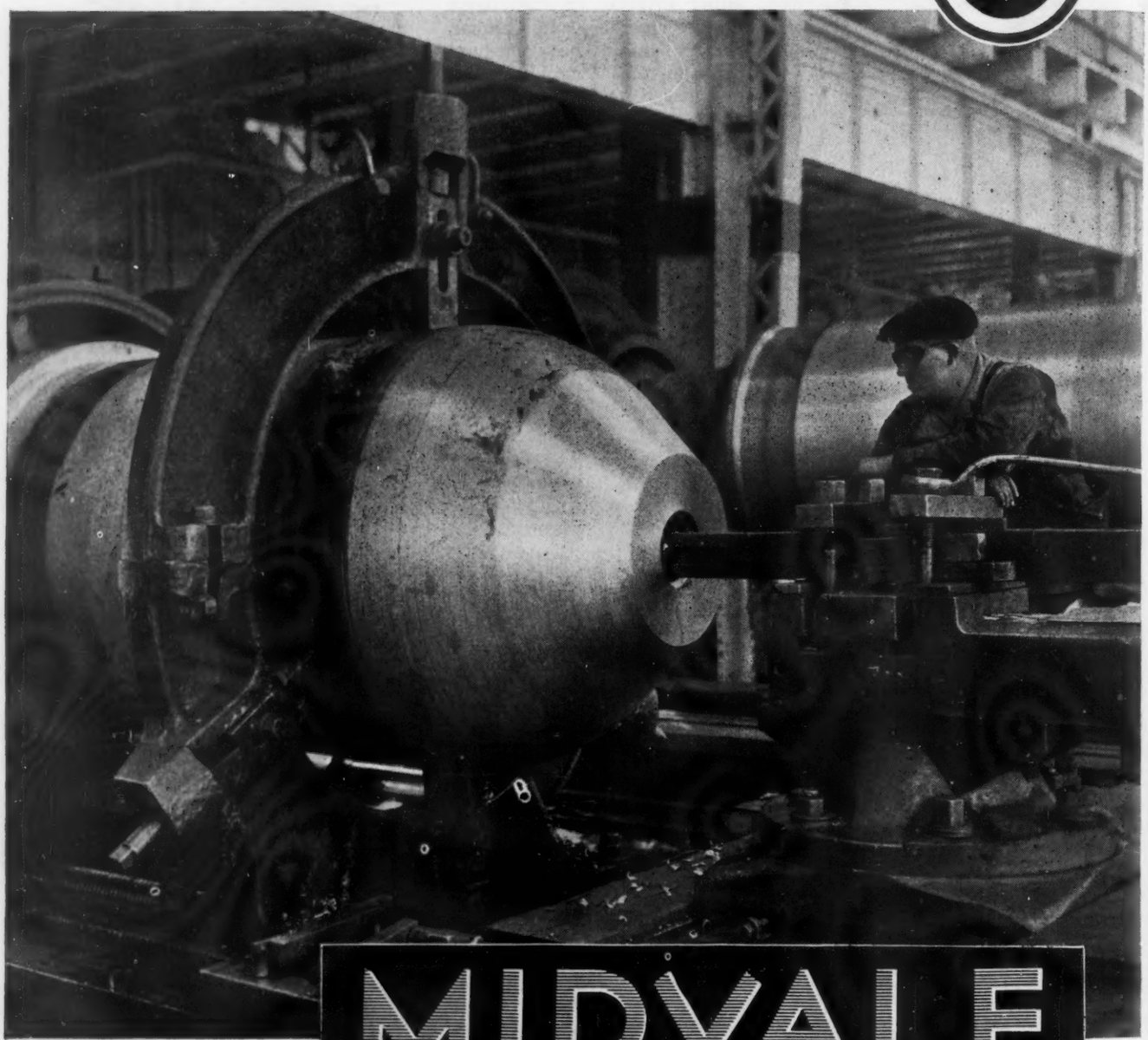
ACME-GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES AND TAPS
THE CHRONOLOG • LIMIT, MOTOR STARTER AND CONTROL STATION SWITCHES • SOLENOIDS • CENTRIFUGES • CONTRACT MANUFACTURING

PRESSURE VESSELS

It is common to nearly all pressure vessels that they must withstand much more than pressure. Corrosives and rapidly changing temperatures subject the metal to conditions of varying severity. Midvale, with one of the oldest and most complete metallurgical laboratories in the industry, combines knowledge with experience. Midvale metallurgists and engineers have shared in the planning and design of notable installations in the oil field and the process industries. And because their studies extend to operation experience, they are doubly equipped to meet unusual and exacting problems.

THE MIDVALE COMPANY • NICETOWN • PHILADELPHIA

OFFICES: NEW YORK • CHICAGO • PITTSBURGH
WASHINGTON • CLEVELAND • SAN FRANCISCO



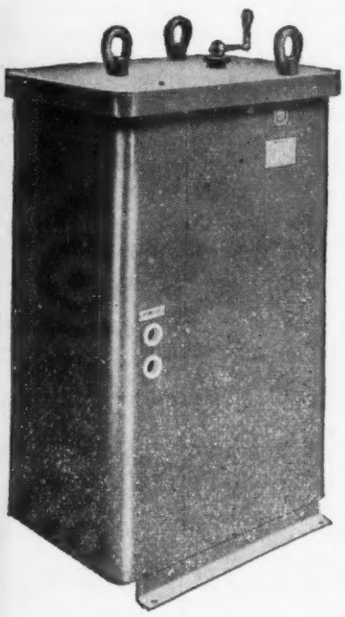
MIDVALE

Custom Steel Makers to Industry

"A-C transformer-type welders? I'd buy 'em from TRANSFORMER HEADQUARTERS!"

"Who do you mean, Steve?"

"Why, Westinghouse, of course. Any a-c welder is built around a transformer, and Westinghouse has been building all types of transformers longer than anybody else—so I'd suggest we get 'em from the outfit that's recognized as transformer headquarters."



A-c welders are essentially transformers. That's why Westinghouse A-C Welders offer the benefit of more years of experience in the designing and building of this type of equipment than any other welder . . . because Westinghouse built the first successful commercial transformers.

A-c electrodes, too, have been developed, tested and proved by Westinghouse to meet welding requirements that range from the lightest welding to the heaviest. In fact, Westinghouse A-C Welders and Electrodes provide the right combination for faster, more economical industrial welding—maintenance, fabrication or construction.

Westinghouse A-C Welders are available in a complete range of ratings from 100 to 2000 amperes. Ask for catalog B-3136 giving full details. Westinghouse Electric & Manufacturing Co., Box 868, Pittsburgh 30, Pa.

J-21315

Westinghouse

A-C WELDERS and ELECTRODES

Advertisement

DIECASTING DIGEST

V—Efficient Injection Is Key to Better, Cheaper Zinc Castings

In the manufacture of zinc die castings, molten metal is delivered from the heated pot to the die, either by air pressure on a closed receptacle or by a hydraulically actuated plunger. In the latter method, the injection system consists of a piston and cylinder to which is attached a gooseneck and nozzle for delivery of hot metal to the die.

Zinc injection systems usually fail as a result of both corrosive and erosive action of hot metal; pistons and cylinders lose their close fit, metal squirts past the piston, injection pressure is lost, inferior castings result.

The injection system employed by Lester-Phoenix die casting machines for zinc, tin and lead alloys is engineered to eliminate these difficulties and to produce strong, dense, smooth-surfaced castings.

Furnace and pot are round, burners are arranged to give tangential flames for maximum heat transfer, low heat loss and less heat fatigue to the machine operator. Pots are made of high-chrome cast iron, cylinder and gooseneck of heat resisting chrome-nickel alloy cast iron, and plunger piston and cylinder sleeve of nitrided nitralloys. In the larger models, such as the HHP-3 shown at the left, the plunger piston and the cylinder sleeve are made of heat treated high-tungsten steels, for maximum wear and heat resistance. All models are equipped with cast iron piston rings, adding materially to the life of the injection system.

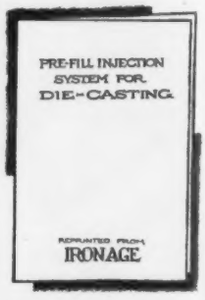
Thus, while the life of the ordinary cast iron injection units ranges from a few hours to a few weeks, Lester-Phoenix systems give months—even years—of uninterrupted service.

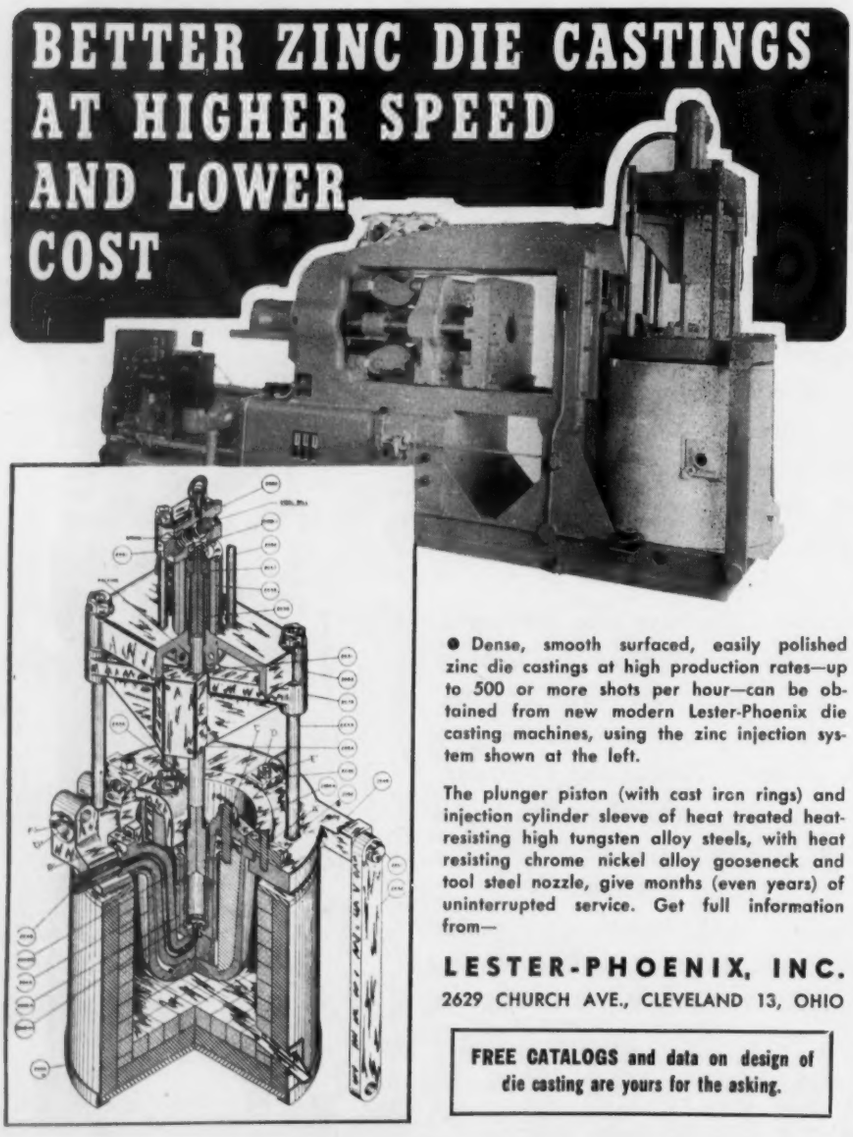
Plunger actuation is by oil under high pressure, providing a positive downward movement and withdrawal, and positive pressure can be held on the casting as it chills in the die. The movement is electrically controlled by solenoid valves, and electric time controls assure exact repetition of any selected casting cycle.

Other exclusive Lester-Phoenix features—sturdy beam-type frame, positive die clamping, rapid toggle and die platen actuation, central die support, single die height adjustment by a handcrank, centrally located hydraulic ejector, to mention a few—combine with a superior injection system to produce better castings at higher speed and lower cost than is otherwise possible.

What About Aluminum Castings?

The best aluminum, magnesium and brass die castings are made by the "slow-squeeze" system of injection. This method is fully described in an article "Pre-fill Injection System for Die Casting", reprinted from a recent issue of *Iron Age*. For a free copy of this article and for data on Lester-Phoenix Die Casting Machines for lead, tin and zinc, write Lester-Phoenix, Inc., 2629 Church Avenue, Cleveland 13, Ohio.





● Dense, smooth surfaced, easily polished zinc die castings at high production rates—up to 500 or more shots per hour—can be obtained from new modern Lester-Phoenix die casting machines, using the zinc injection system shown at the left.

The plunger piston (with cast iron rings) and injection cylinder sleeve of heat treated heat-resisting high tungsten alloy steels, with heat resisting chrome nickel alloy gooseneck and tool steel nozzle, give months (even years) of uninterrupted service. Get full information from—

LESTER-PHOENIX, INC.
2629 CHURCH AVE., CLEVELAND 13, OHIO

FREE CATALOGS and data on design of die casting are yours for the asking.

LESTER-PHOENIX
DIE CASTING MACHINES

HERE
n·B·m BRONZE PARTS
STAND TRIAL - -
GUILTY UNTIL PROVED INNOCENT!

In this "court"—N-B-M's modern research laboratories—bronze parts must endure the most critical cross-examinations and tortures unmerciful engineers can devise.

Alloys are analyzed for grain and composition.

"Pours" must prove their metal under fire.

Castings are subjected to every punishment they must endure in actual use.

The judgment of this jury is stern. Only castings that acquit themselves completely under rigid metallurgical and manufacturing controls are worthy to be . . .

N·B·M BRONZE PARTS

NBM

NATIONAL BEARING METALS CORPORATION

ST. LOUIS • NEW YORK

AMERICAN Brake Shoe

PLANTS IN: ST. LOUIS, MO. • PITTSBURGH, PA. • MEADVILLE, PA. • JERSEY CITY, N. J. • PORTSMOUTH, VA. • ST. PAUL, MINN. • CHICAGO, ILL.

SEYMOUR

NICKEL SILVER

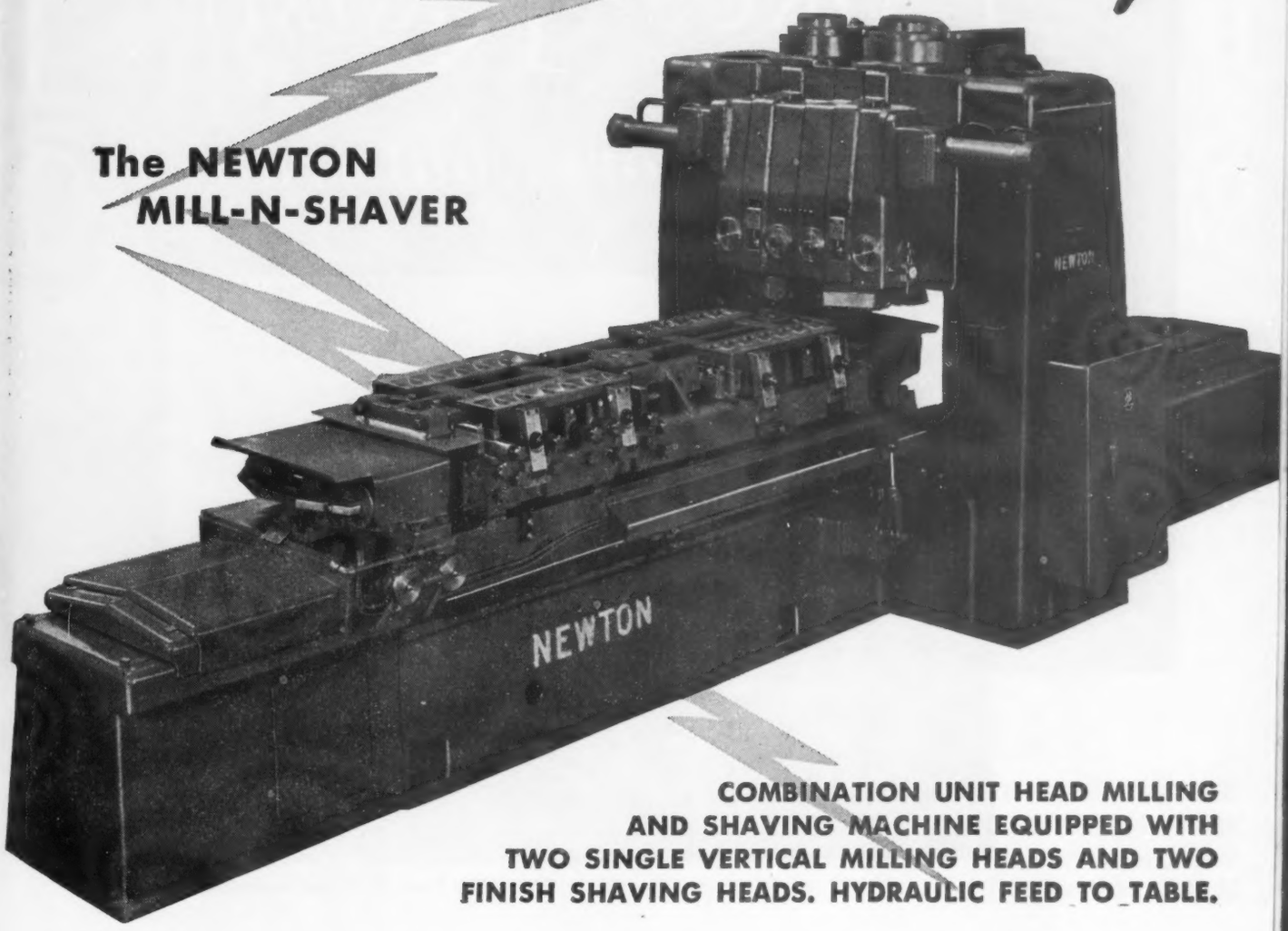
When the war is over, Seymour Nickel Silver will resume its role in the manufacture of untold thousands of useful and ornamental products. Chief of these is plated ware, for which it is the ideal base. Because of its even grain and fine ductility, it flows smoothly under spinning tool or forming die. And, when eventually exposed by wear, its silvery white color will match the surrounding plate and take a high polish. Still another advantage of Seymour Nickel Silver is that no preplating is necessary on articles to be silver, nickel or chromium plated.

If you are interested, we'll be glad to help you plan your postwar products.

THE SEYMOUR MANUFACTURING CO., SEYMOUR, CONN.

TWO SEPARATE OPERATIONS.....
IN THE TIME REQUIRED FOR ROUGH MILLING — *ALONE*!

The NEWTON MILL-N-SHAVER



COMBINATION UNIT HEAD MILLING AND SHAVING MACHINE EQUIPPED WITH TWO SINGLE VERTICAL MILLING HEADS AND TWO FINISH SHAVING HEADS. HYDRAULIC FEED TO TABLE.

The Newton Mill-N-Shaver performs two complete operations at one pass of the table. It rough mills at milling speed and finish shaves on the return, at the rapid traverse speed. This machine produces a perfect gasket surface . . . two separate operations . . . in exactly the time ordinarily required for rough milling alone. The Newton Mill-N-Shaver is designed to both step-up your production and reduce your costs on the types of work for which this machine is adapted. For detailed information, write for Bulletin No. 580.

BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION

ROCHESTER 10, NEW YORK

PORUS-KROME

a fish story..but true

Part of New England Fleet at Boston Fish Pier

80% of the New England fishing fleet boats have Lister-Blackstone auxiliary Diesel engines. This rugged engine is made still more reliable by having PORUS-KROME liners in its cylinders . . . a standard specification for every Lister-Blackstone engine.

PORUS-KROME resists both corrosion and abrasion and multiplies cylinder life from 4 to 20 times. Its porosity assures better lubrication, too. These characteristics are especially needed where the engines "run cold" as they do in fishing boats . . . and in other engines, too, which are used in cold weather.

Whether you build engines or use them, be sure that PORUS-KROME is on the cylinder walls. Write for full information.

PORUS - KROME

Good for the Life of your Engines

VAN DER HORST

U. S. PATENTS 2,048,578 AND 2,314,604

VAN DER HORST CORPORATION OF AMERICA

AN AFFILIATE OF DRESSER INDUSTRIES

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CLEVELAND 11 • OHIO

PRECISION INSPECTION AND MANUFACTURING

The Sheffield Corporation has provided industry with a broad line of precision gages and instruments for the dimensional control of manufactured mechanical parts of all kinds. These include the Visual Gage, Precisionaire, Multichek, Electrigage, Electrichek, Internal and External Measuring Instrument, Thread Checking Instruments and Automatic Gaging Machines. Only a few of these are illustrated here.

FOR THE MANUFACTURE OF PRECISION THREADS AND FORMS

The Micro-Form Grinder provides the most economical method of grinding both flat and circular form tools from carbides and steels. Precision forms and threads are most accurately produced in a shorter time, often by plunge grinding, on the Precision Thread and Form Grinder with a crusher dressed multi-ribbed wheel. These machines can also be used in making crusher rolls for dressing surface grinder wheels.

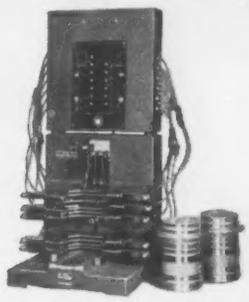
SHEFFIELD CONTRACT SERVICES

As one of a very few American manufacturers producing both machine tools and precision inspection equipment, Sheffield is excellently prepared to coordinate both quantity and quality production. In this connection, Sheffield serves many manufacturers on tooling programs and maintains a large staff of expert tool engineers. Sheffield offers the combined services of both the tool engineering department and the manufacturing department or either individually.

Contract production for other manufacturers include also precision threaded parts, form tools of all kinds, sub-assemblies and complete assemblies.

WRITE FOR ENGINEERING DATA

***VISUAL GAGE**, available in six amplifications, for checking external dimensions both in process and final inspection. Angularity of surfaces, angularity between a surface and a bore, surface run-out, pitch diameter of screw threads, internal dimensions, and other critical conditions can be checked with the use of standard and special accessories.*

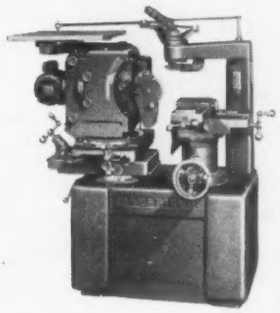


***SHEFFIELD MULTICHEKS** inspect from 2 to 20 and more dimensions (both upper and lower limit) simultaneously in one operation. Savings in time, floor space, inspection and production costs normally offset the cost of a Multichek in from 6 to 12 weeks.*

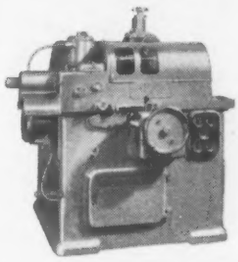
***THE PRECISIONAIRE** is a flow-type air gage for measuring internal and external dimensions, bell mouth, out-of-round and average diameters of through, blind and step holes. It checks both GO and NOT GO limits in one pass very much faster and with 10 to 40 times less gage wear than can be done with fixed size gages. The human element of error does not enter.*

***THE SHEFFIELD INTERNAL - EXTERNAL MEASURING INSTRUMENT** with Electrigage.*

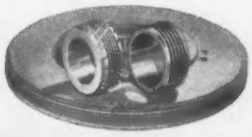
***TYPE C AIRSNAP** for checking external dimensions.*



***This is the SHEFFIELD PRECISION THREAD AND FORM GRINDER** using the amazing crusher roll method of dressing a multi-ribbed wheel for the production of threads or forms by either plunge or traverse grinding. Can also be used as a conventional single point grinder.*



***THE SHEFFIELD MICRO-FORM GRINDER** grinds any flat or circular form tool, profile work or wheel crusher rolls to an accuracy of .0003" directly from a 50 to 1 layout drawing—no template required. It saves up to 75% in machine time over conventional methods, especially on carbides.*

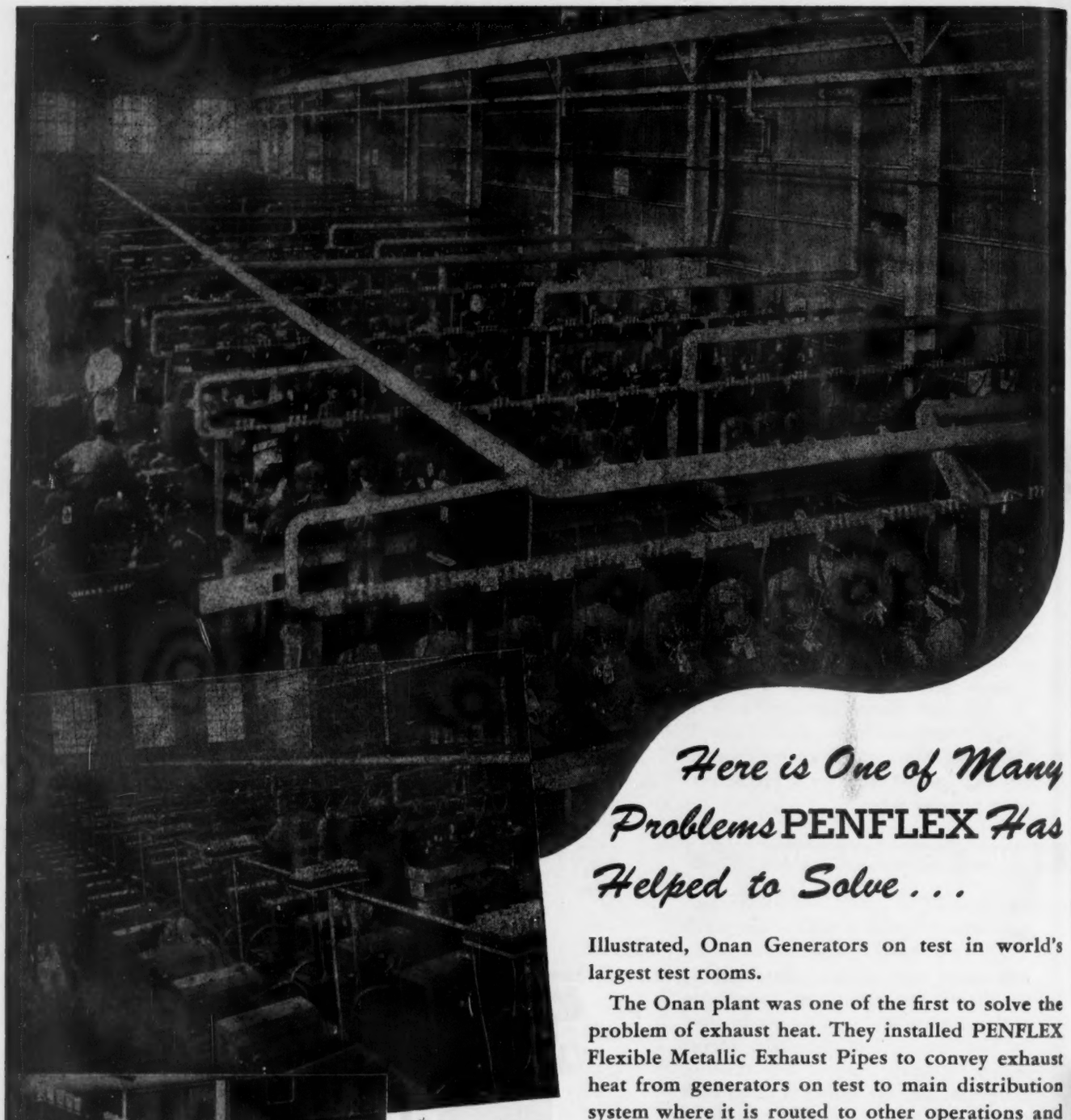


Multi-ribbed wheel, crusher roll and work part.

THE SHEFFIELD CORPORATION

Dayton 1, Ohio, U. S. A.

MACHINE TOOLS • GAGES • MEASURING INSTRUMENTS • CONTRACT SERVICES



Here is One of Many Problems PENFLEX *Has Helped to Solve . . .*

Illustrated, Onan Generators on test in world's largest test rooms.

The Onan plant was one of the first to solve the problem of exhaust heat. They installed PENFLEX Flexible Metallic Exhaust Pipes to convey exhaust heat from generators on test to main distribution system where it is routed to other operations and re-used. A PENFLEX Flexible Metallic Exhaust is packed with each generator to be used wherever Onan sets are found.

Four-wall interlocking joint construction, flexibility, and insulation against vibration make PENFLEX suitable for such a job.

PENFLEX Flexible, All-Metal Hose or Tubing is also available for bilge ventilation, dust collection, coolant conveying, vibration isolation, hydraulic and air controls and many other applications.

Perhaps you, too, have a similar problem. If so, our Engineering Department will help you solve it.

PHOTOS COURTESY D. W. ONAN

PENNSYLVANIA FLEXIBLE METALLIC TUBING CO.
7219 Powers Lane, Philadelphia 42, Pa.
ESTABLISHED 1902

The Shape of Things to Come . . .
at Consolidated Vultee Aircraft

One of a battery of Kane & Roach No. 1 Vertical-Type Angle Benders at the Consolidated Vultee plants, bending heavy extruded and formed shapes to the exacting contours required by the aircraft industry.

Formed on

KANE & ROACH
BENDING ROLLS

Fast bending of bars, tubes, formed and extruded sections to precision dimensions—all with a minimum of labor and down-time for service. And all saving precious hours in fairing the surfaces and structural members of giant B-24 Bombers.

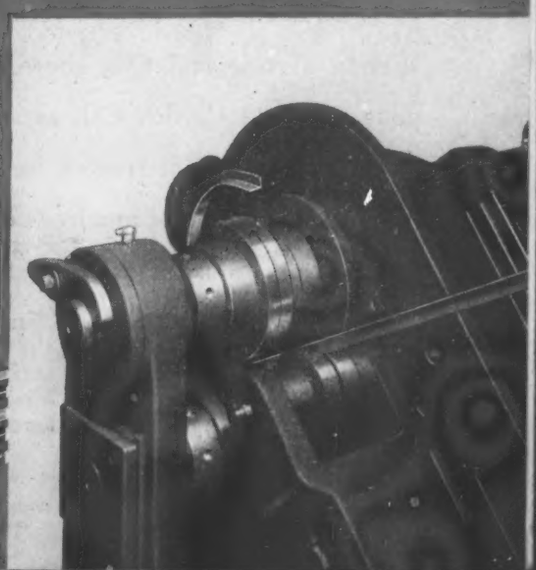
That's how Kane & Roach Bending Rolls are helping Consolidated Vultee Aircraft Corporation turn out the Liberator B-24's that are making daylight raids on Europe. And that's how Kane & Roach metal forming machinery (both hot and cold roll) will help turn out the planes that will bomb Tokyo and other Japanese cities by day and night. Famous in heavy industry for 57 years, Kane & Roach bending and forming machines are important production tools in big aircraft and munitions factories all over America.

KANE & ROACH, INC.
Syracuse, New York

A Few of the Shapes that Can Be Formed and Bent on Kane & Roach Forming and Bending Rolls

High-speed, precision forming of strips to angle-sections, channel-sections, U-sections and various special shapes are possible with this Kane & Roach cold-roll forming machine.

Twenty-three of these Kane & Roach No. 50 Pinch-Type Bending Rolls are in daily use at the Consolidated Vultee Aircraft plants.



Protected by ONE Cardox Fire

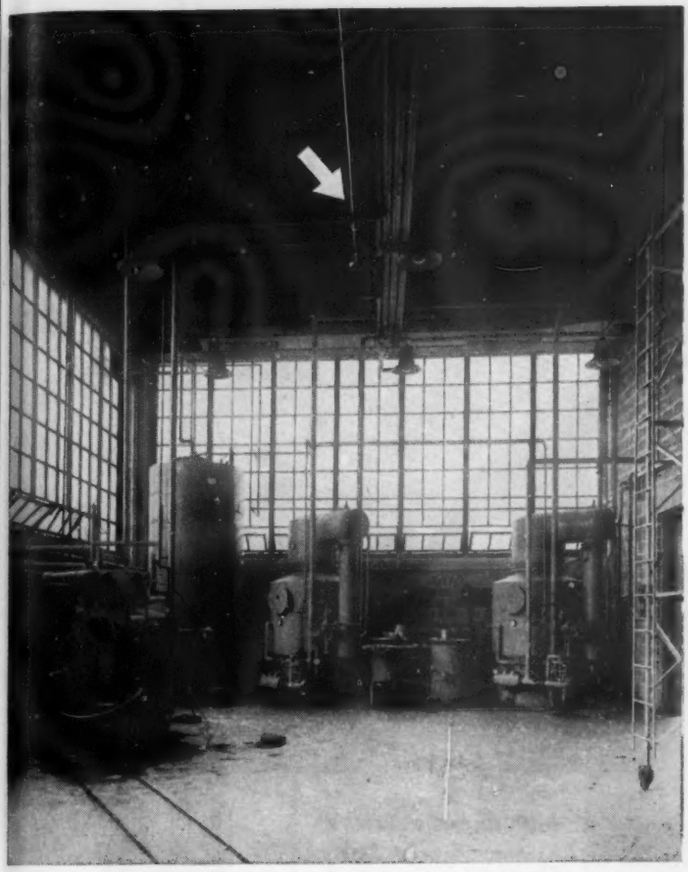
The five oil processing and storage rooms illustrated here . . . plus four others and a long pipe tunnel that could not be photographed . . . represent a major fire hazard in one of America's large war plants. All nine rooms and the pipe tunnel . . . 941,140 cubic feet . . . are guarded by *a single* engineered Cardox Fire Extinguishing System.

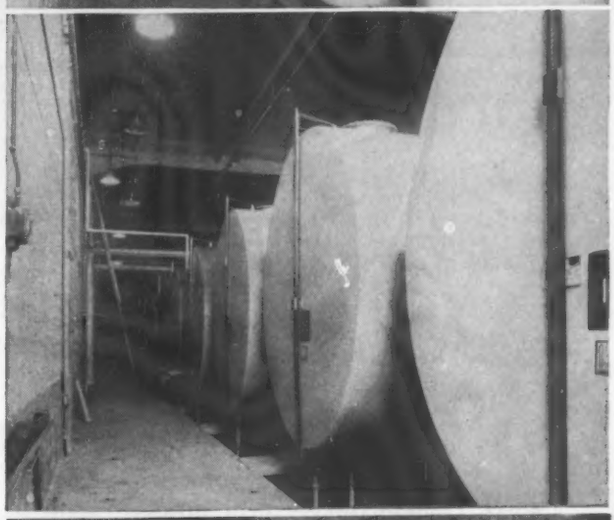
Total flooding of any of these rooms with inert carbon dioxide and CO_2 snow is provided by 12 tons of liquid Cardox CO_2 as soon as fire strikes . . . with substantial reserve for new emergencies.

Here is only one of hundreds of examples of how engineered Cardox Fire Extinguishing Systems utilize fast-acting, non-damaging, inexpensive carbon dioxide to provide enhanced extinguishing performance in protecting *large* and *small* hazards.

The enhanced extinguishing performance of carbon dioxide, as controlled and applied in Cardox Systems, is due to these four basic factors: (1) It has uniform extinguishing characteristics regardless of plant or atmospheric temperatures; (2) It is available in ample quantity for application at high rate and for total flooding (when necessary) of large areas; (3) It provides high CO_2 "snow" yield for increased cooling effect; (4) It achieves effective projection through relatively great distances—even outdoors.

The hazards in your plant may not be as *large* as those shown here, but the kind of extinguishing performance that has caused Cardox Systems to be specified for guarding hazards such as these has a place in your fire protection plans. Cardox engineers offer you practical cooperation.





Extinguishing System

Write for details and Bulletin 815

CARDOX CORPORATION

BELL BUILDING • CHICAGO 1, ILLINOIS

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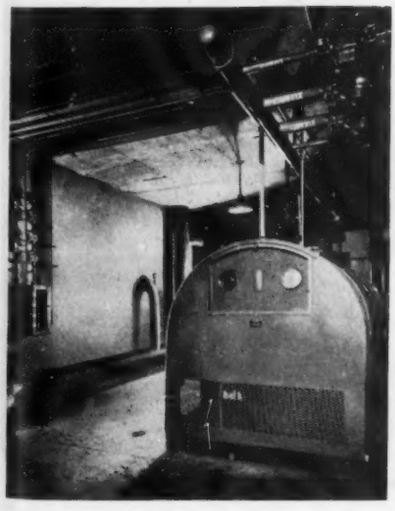
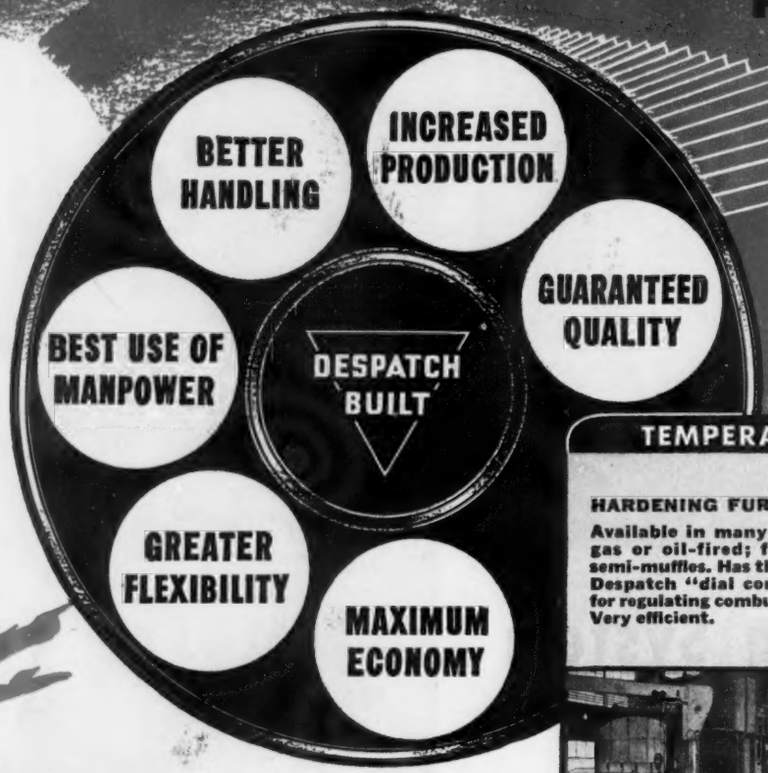


All of the areas illustrated here represent Class B hazards . . . involving volatile and flammable liquids. Total flooding with Cardox CO_2 is applied at the highest practicable rate to create an extinguishing concentration in the minimum length of time. An adequate supply of liquid carbon dioxide to cover all of the hazards illustrated is maintained in a single refrigerated Cardox Storage Unit similar to one pictured at left.

CARDOX

CO_2 FIRE EXTINGUISHING SYSTEMS

CHOOSE YOUR RESULTS and GET THEM in a DESPATCH HEAT TREATING FURNACE



42 YEARS Experience in Designing and Manufacturing Heat Processing Equipment.

REAL DEPENDABILITY in a furnace means getting *all* the results you're after . . . all the performance advantages which mean most to your particular heat treating program, whatever it may be.

Despatch furnaces provide just this. And in meeting stiff requirements for production, quality, speed, economy and other factors, they simply reflect the engineering "know how" that comes with 42 years of specialized experience.

Just as this Despatch furnace performance has helped heat treaters set new records in wartime production, so it will help *you* get the results you'll urgently need during reconversion and later.

ASK FOR BULLETINS, *folders and other material telling what Despatch Furnaces can do for you.*

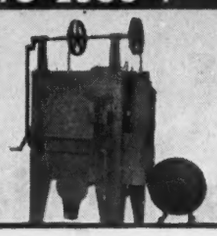
ALL SIZES...ALL TYPES...ALL FUELS and the material-handling systems best for your job!

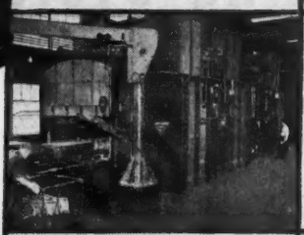
DRAWING • HARDENING • TEMPERING • STRESS RELIEF • NORMALIZING
CARBURIZING • SOLUTION HEAT TREATING • FORGING • FORMING
AGING • BRAZING • PREHEATING

TEMPERATURES TO 2500° F

HARDENING FURNACE

Available in many sizes, gas or oil-fired; full or semi-muffles. Has the new Despatch "dial control" for regulating combustion. Very efficient.



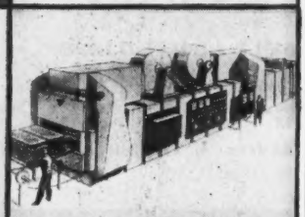


ANNEALING FURNACE

Ingenious automatic "pusher" type furnace; handles 14,000 lbs. of alloy steel per hour. Inserts, heat treats and discharges load baskets without human effort.

NON-FERROUS HEAT TREATING FURNACE

100% automatic Despatch furnace for heat treating and quenching aluminum sheets. Entire operation is time-cycle controlled. Special brochure on request.

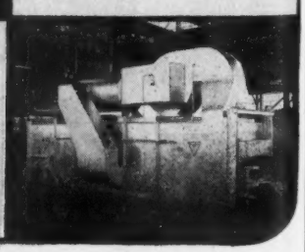


PIT TYPE FURNACE

Compact, efficient Despatch furnaces, electric or gas-fired; ideal for both ferrous and non-ferrous work. . . . Available in all standard sizes.

BILLET HEATING FURNACE

A 5-belt conveyor-type Despatch furnace; gas-fired. Billets ride on independently-controlled conveyor belts, are discharged as desired.



DESPATCH OVEN COMPANY MINNEAPOLIS 14 MINNESOTA, U.S.A.

Advertisement

JANUARY, 1945

COPPER ALLOY BULLETIN

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared Each Month by the Bridgeport Brass Co. "Bridgeport" *Headquarters for BRASS, BRONZE and COPPER*

Outlook for 1945

Future of Copper-Base Alloys is Bright... Newer Alloys Set Modern Engineering Standards

Intensive research and development on copper-base alloys in the last decade has completely changed the picture for brasses and bronzes. Where once the application of these materials for engineering purposes was limited because of moderate strength and the possibilities of stress corrosion cracking, the new alloys, some of which comprise silicon bronzes and aluminum bronzes, are of a far superior nature. Tremendous strides have been made, and development engineers and product designers should carefully study the properties of the new copper-base alloys. They will find themselves outdated if they stick to the old metal specifications. Alert designers are, therefore, carefully considering existing products with a view toward modernizing them by replacing weaker materials with modern copper-base alloys.

Silicon Bronzes for Cold Upsetting

Cap and machine screws and bolts made from copper silicon alloys (DURONZE V, for example) average over 100,000 pounds per square inch in tensile strength on most sizes. This results in a product which is about 50% stronger than ordinary low carbon steel bolts, which average about 70,000 pounds per square inch or less, in tensile strength. Since silicon bronze bolts are not subject to stress corrosion cracking, and are far superior to steel in corrosion resistance they are used for outdoor and other types of exposed construction, in place of materials which rust away, or are apt to fail from season cracking. Silicon bronze bolts are also used submerged in water or buried in the soil—conditions which destroy ordinary materials. From an engineering standpoint, the use of silicon bronzes as outlined above means less maintenance and much greater freedom from failure.

From a fabrication standpoint, the silicon bronzes offer no special problems. Bolts are made from wire by cold heading and roll threading with the same equipment as used for making steel bolts. Alloys, such as DURONZE V, are very malleable even in the form of hard drawn wire used for making cold headed products. Furthermore, cold headed DURONZE V parts do not require intermediate and final heat treatments because they are less susceptible to overworking. Because of the saving in scrap, the tendency is toward fabricating by the cold forming or upsetting process. Nuts are also being manufactured by the upset process. When silicon bronze is used for making cold upset nuts, the final product is remarkably strong and practical.

Aluminum Bronzes for Machining and Hot Forging

Aluminum Bronzes, such as DURONZE III, have shown so great a promise in the last few years that their future is assured. It seems only yesterday that such alloys were in disfavor by brass companies because of the difficulty encountered in making them. Although the fine properties of aluminum bronzes have been known for many years, the old fashioned pit-fired furnaces, with temperature controlled by natural draft, were entirely unsuited for melting these alloys because of danger from oxidation. Moreover, because aluminum bronzes are stronger and tougher than the brasses, more powerful machinery is required to process them. Up-to-date brass mills equipped with modern electric melting furnaces and powerful rod and tube extrusion presses, tube reducing machinery, huge draw benches and gigantic hot and cold rolling mills are now in a position to produce these alloys.

DURONZE III, a silicon aluminum bronze containing 91% copper, 7% aluminum and 2% silicon, is about 50% stronger than Naval Brass rod in the annealed condition. In other words, it has a tensile strength of about 90,000 pounds per square inch as compared with approximately 60,000 pounds per square inch for Naval Brass (minimum). The greater tensile and yield strengths, higher hardness values and greater fatigue limits are a combination of properties much sought for by engineers. In addition, aluminum bronzes are more corrosion resistant than brasses. Moreover, when in contact with moving parts made from steel or other materials, aluminum bronzes offer less friction, with consequently less wear. They have less tendency to gall and are excellent for the manufacture of valve stems, gears, pinions, pump parts, solderless connectors, high strength bolts, marine hardware, etc., where both strength and corrosion resistance are needed.

The use of aluminum bronzes in combination with steel parts has reduced maintenance because of less wear and corrosion. In many cases the parts made from DURONZE III, for example, have outlasted former materials six to one and even more. This alloy is supplied in rod form and can be made into high strength screw machine parts because it machines from 50% to 70% as rapidly as free cutting leaded brass rod. DURONZE III can also be readily hot forged. Such forgings average about 85,000 to 90,000 pounds per square inch tensile strength as compared to about 50,000 pounds per square inch for hot forged brass.

Reducing Dead Weight with Aluminum Bronzes

Because DURONZE III is stronger and lighter than brass, it is possible to replace Naval Brass rod with this alloy, at a saving of from 40% to 50% in dead weight, without sacrificing tensile or yield strength. DURONZE III, for the same sizes, is about 9% lighter in weight than Naval Brass. Wherever dead weight is a factor, such as on ships, planes, trains, elevators and moving machinery, many parts can be replaced by smaller and lighter parts of equal strength made from DURONZE III. This saving in weight can be utilized for carrying a paying load. No doubt there are many other items in addition to the above where weight saving is desirable.

Advantages of Copper-Base Alloys

The war with its insatiable demand for copper, brass and bronze has made it necessary to use substitute materials when copper has not been available for the less essential purposes. The fine properties and ease of workability of copper-base alloys are now appreciated more than ever.

Every manufacturer is interested in materials which will both serve the purpose intended, and yet be easy to work or fabricate. To keep production running smoothly he must have uniform material exactly suitable for his operations, and free from blemishes. Also he requires a material which will not wear out his tools too rapidly and increase his costs. These factors will be more important than ever in the postwar period because as labor costs rise, manufacturing methods must become more efficient. Close cooperation between the brass mill and the consumer can do much toward encouraging the use of the most efficient materials for fabrication. Most of the desirable qualities listed below can be found in a single copper-base alloy.

1. Wide range of physical properties controlled by simple processing operations.
2. Corrosion resistance.
3. Dependable, satisfactory service.
4. Great strength and hardness.
5. High heat conductivity.
6. Resistance to fatigue, abrasion and wear.

(Continued on page 2, column 2)

COPPER ALLOY BULLETIN

CAUSES OF CORROSION

This article is one of a series of discussions by C. L. Bulow, research chemist of the Bridgeport Brass Company.

ACCELERATED CORROSION— COLD WALL EFFECT

In the previous issue we discussed the "hot wall effect" and showed that the liberation of a gas or precipitate on a hot metal surface might lead to severe localized corrosion. We shall now consider the "cold wall effect" which is encountered wherever condensation occurs on a cold metal surface.

Industrial Importance of Cold Wall Effect

The condensation of a vapor or gas to a liquid on a cold surface is a physical change of considerable industrial importance. At times this phenomenon may cause annoyance as in the case of the "sweating" of cold water pipes.

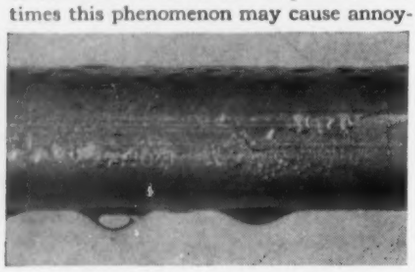


Fig. 1—Condensate collecting on cold tubing.

The condensation of exhaust steam on the surfaces of tubes in surface condensers used in conjunction with steam turbines is an important step in the economical production of electric power. In the chemical and petroleum industries, many millions of feet of tubing are used in the form of condensers and heat exchangers to change various gases such as gasoline, the alcohols, acetates, ketones, et cetera, into the liquid state. In most of these applications, the copper-base alloys give excellent service. For example, steam and alcohol usually corrode these alloys at rates less than 0.0001" per year. On the other hand, under unusually severe conditions, encountered in the production of gasoline and certain chemicals, the corrosion rate may be as high as 0.0005" up to 0.050 inches per year.

Corrosion Associated with the Cold Wall Effect

The condensation of water vapor on a cold metal surface leads to the formation of droplets of water as shown in Figure 1. Under most conditions, these droplets form,

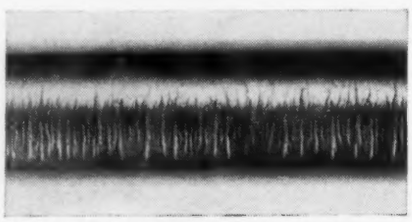


Fig. 2—Corrosion grooves produced by corrosive condensate.

grow and roll off the tube without producing any noticeable amount of corrosion. Occasionally, an unusual situation is encountered where the water droplet has absorbed small amounts of corrosive materials such as hydrochloric acid, ammonium hydroxide, sulphur dioxide, etc., which may lead to the formation of deep corrosion grooves in the side of the tube as illustrated in Figure 2. This occurs where the droplets of water form repeatedly at the same spot and roll down the same area on the tube surface. This may also take place where two immiscible liquids condense side by side. Sometimes, considerable longitudinal grooving or pitting may occur on the bottom side of the tube where the droplets of corrosive liquid may hang for some time before dropping off. Usually considerably more thinning of the tube wall occurs on the bottom side of the tube as compared with the top side. An acid condensate flowing down the side of a sheet of metal may in time also produce long, deep, corrosion grooves.

Outlook for 1945

(Continued from page 1)

7. Fine spring qualities.
8. High electrical conductivity.
9. Pleasing color.
10. Non-magnetic.
11. Ease of finishing, plating, lacquering.
12. Ease of cold and hot working.
13. Machineability.
14. Ease of brazing, soldering, welding.

Research and Development

Many new alloys and improved old ones are resulting from the work done by research departments in brass mills. This work has been stepped up during the past few years. A consistent program of research has brought forth much new information regarding the corrosion resistance and physical properties of standard brass mill alloys. This puts the metallurgist in a better position to help the designing engineer to select the alloy best suited for the purpose. Continued improvement in the quality of basic materials makes possible lower costs in mass production of precision quality products.

Every manufacturer will benefit by closely examining every possibility of using copper-base alloys for better performance and easier manufacture in the fields of transportation, housing, communications; manufacturing and chemical processing plants, oil refineries and many others. Since dependability and satisfactory performance are most important engineering requirements, the future of the copper-base alloys has never been brighter.

NEW DEVELOPMENTS

This column lists items manufactured or developed by many different sources. None of these items has been tested or is endorsed by the Bridgeport Brass Company. We will gladly refer readers to the manufacturer or other sources for information.

Copper Plating Process to reduce costs and increase speed. The process substitutes small amounts of potassium cyanide and other potassium salts for sodium cyanide. Makers of tanks, planes, motorized equipment and other military items are reported to use it for plating numerous engine parts and other items requiring a copper plate. **(586)**

A New, Non-Destructive X-Ray Diffraction Unit can be used with the new low-angle-scatter cameras or other standard types of photographic equipment. Utilizing full wave rectification, the new equipment is expected to prove invaluable in welding, casting, forging, etc. **(587)**

A New Type Metallizing Gun, developed for high-speed production spraying of low melting point metals. It is said to be capable of using ⅛ in. zinc, tin, lead, solder, babbitt, cadmium, or fine gage copper and its alloys. A patented controlled power unit provides efficient automatic spraying hour after hour. Air pressure fluctuations are reported not to affect its operating efficiency. **(588)**

A Small Barrel Plating Unit for handling such small pieces as springs, catches, rings, pins, screws, etc., has a capacity of 2 gals; may be used for copper, nickel, brass, silver, etc. It consists of adjustable cathode and anode, and a slowly rotating tilted tub. The power unit electric motor can be plugged into any convenient outlet. **(589)**

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CONDENSER, HEAT EXCHANGER, SUGAR TUBES—For steam surface condensers, heat exchangers, oil refineries, and process industries.

PHONO-ELECTRIC* ALLOYS—High-strength bronze trolley, messenger wire and cable.

WELDING ROD—For repairing cast iron and steel, fabricating silicon bronze tanks.

LEDRITE* ROD—For making automatic screw machine products.

BRASS "Bridgeport" CONN.

Established 1865

BRASS, BRONZE, DURONZE WIRE—For cap and machine screws, wood screws, rivets, bolts, nuts.

DURONZE ALLOYS—High-strength silicon bronzes for corrosion-resistant connectors, marine hardware: *hot rolled sheets* for tanks, boilers, heaters, flues, ducts, flashings.

COPPER WATER TUBE.

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Note: Bridgeport products are supplied in accordance with existing priority regulations.

*Trade name.

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Our plant facilities and experienced manpower belong in your picture . . .

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Let's talk it over . . .

Write for the Free Booklet on our facilities for the production of piston pins; ball bearings; hardened and ground screw machine parts; heat treated and hydrogen copper brazed steel stamping or forging assemblies. Burgess-Norton Mfg. Co., 200 Peyton Street, Geneva, Illinois.

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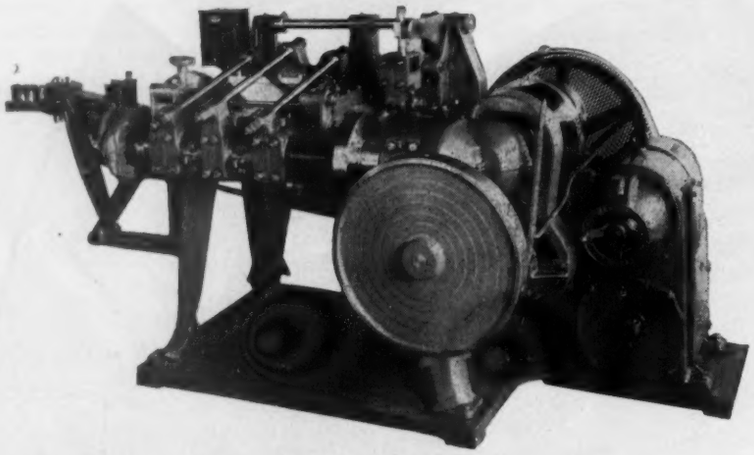
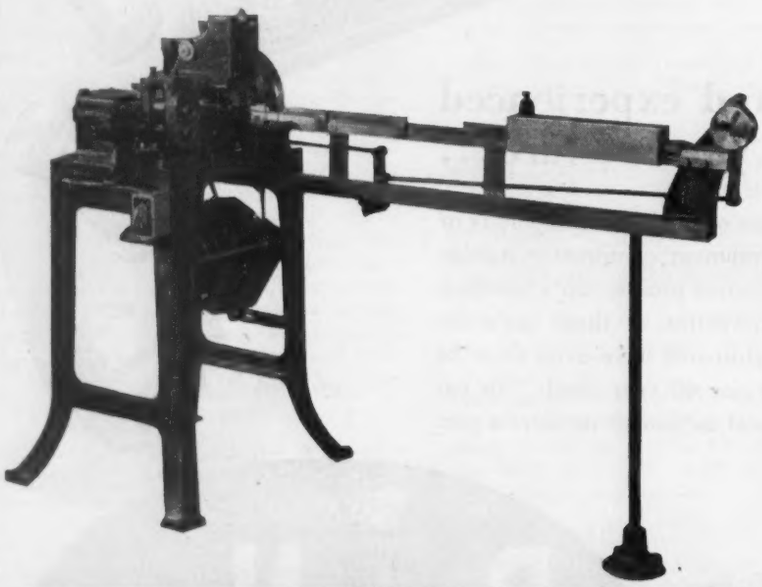
40 years in GENEVA, ILLINOIS

A Part is Never Made Right Unless it is Satisfactory to Our Customers

NILSON . . . .



The NILSON Automatic Metal Wire Forming Machine is sturdy, solid and compact. It is highly efficient and a practical machine for forming wire and punching patterns from ribbon stock.



The NILSON Automatic Staple Forming Machine insures speed without impairing accuracy. Special attachments and patented features contribute to this fact. It is of the plunger type and a special feature is the production of chisel-point staples.

WIRE AND METAL FORMING MACHINES

NILSON automatic forming machines are answers to the demands for uniformity at increased speeds in the production of thousands of different formed parts from wire and metal strip.

NILSON makes various models adapted to produce parts of this nature but it is amazing how versatile each of these models is and how many different products can be turned out on a single machine.

NILSON automatic wire and metal forming machines are positive in automatic straightening and feeding, fast in operation and easy to tool up. Fifty years of experience in special machine building are behind these products and sound engineering practice dictates every design. If you produce wire and small metal parts, investigate; send for bulletin describing these and other NILSON products such as wire straighteners, wire reels, frame bending machines and special presses.

THE A. H. NILSON MACHINE CO. BRIDGEPORT, CONN.

Improve SIZING OPERATIONS with KENNAMETAL Balls

Kennametal's modulus of elasticity, 2 to 3 times that of steel, enables it to effectively resist deformation. This property, in combination with amazing wear-resistance due to exceptional hardness, ideally suits Kennametal balls for economical, accurate burnishing operations. For example—Kennametal balls, used to burnish holes to size in hardened steel bushings ¾" long, held tolerance and concentricity for 60,000 operations. Steel balls, on the same operation, produced only 600 sizings. On this job, the use of Kennametal balls practically eliminated defective work, and saved approximately 90% of the time previously required to check gage of holes sized with steel balls.

Kennametal balls can be supplied from stock in ten standard sizes, ranging from 1/8" to 1" diameter. Special sizes can be provided. Catalog 44 contains particulars and prices. A copy is yours for the asking.

Advantages of KENNAMETAL Balls

- Hold size within tolerance for thousands of operations.
- Improve concentricity, and maintain gage of hole.
- Produce work-hardened, mirror-smooth finish.
- Reduce rejects to a minimum.

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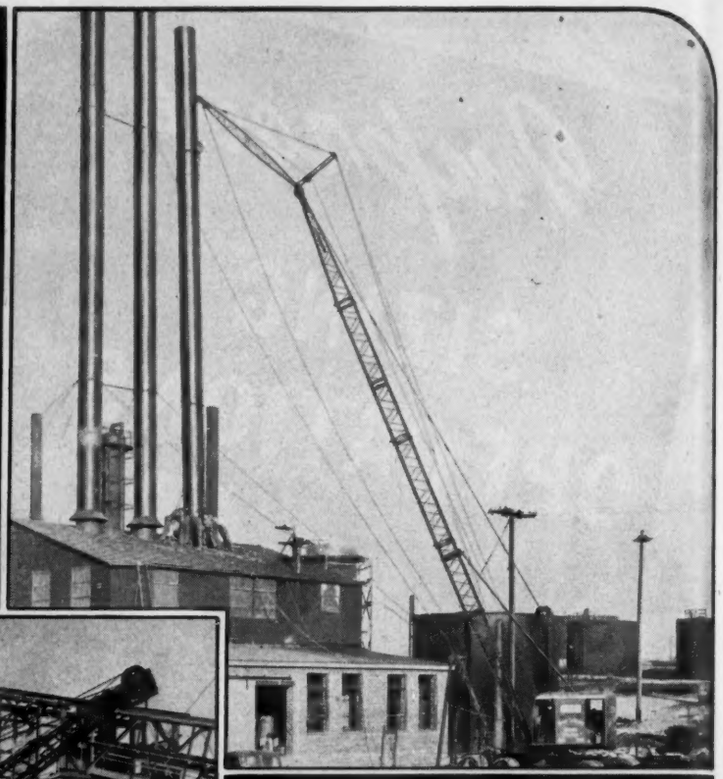

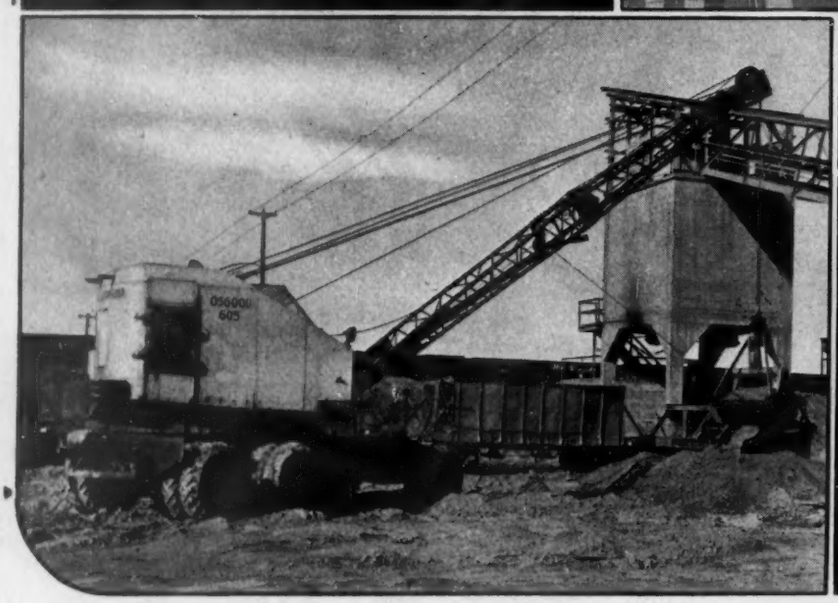

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INCREASE PAY LOAD

. . . without increase in gross weight

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3. The permanent, silvery beauty of ENDURO eliminates painting except for decorative purposes.

4. Other reasons include ENDURO's high resistance to rust, corrosion, rough use and abuse.

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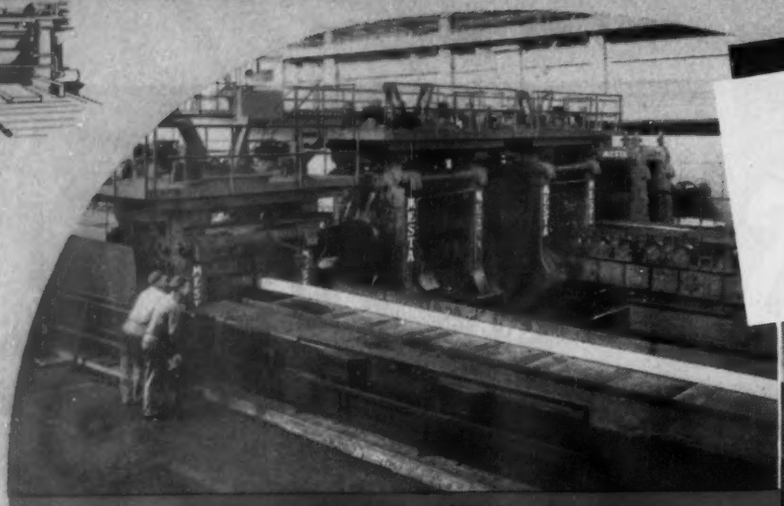
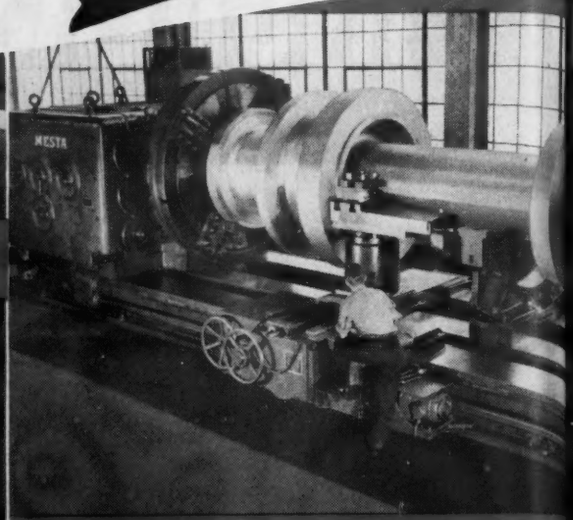


Mesta 29" Structural Mill Showing Travelling Tilting Table



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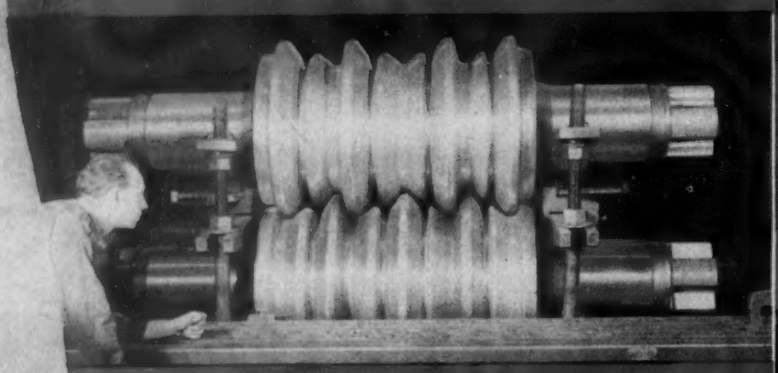
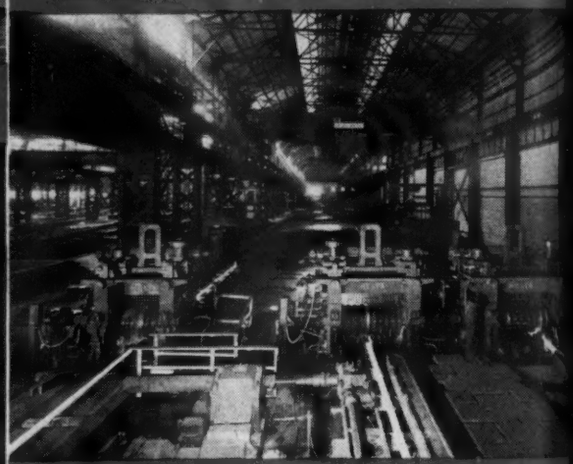


Mesta Grain Merchant Mill Rolls for Small Beams and Channels



Mesta 32" Two-High Bar Mill, Showing Transfers and Manipulators

Forging 16" Gun Tube at Mesta on a 6,000 Ton Hydraulic Press

Turning Mesta Special Alloy Cast Steel Backing-Up R

Mesta 36" Blooming Mill

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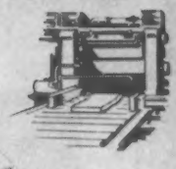
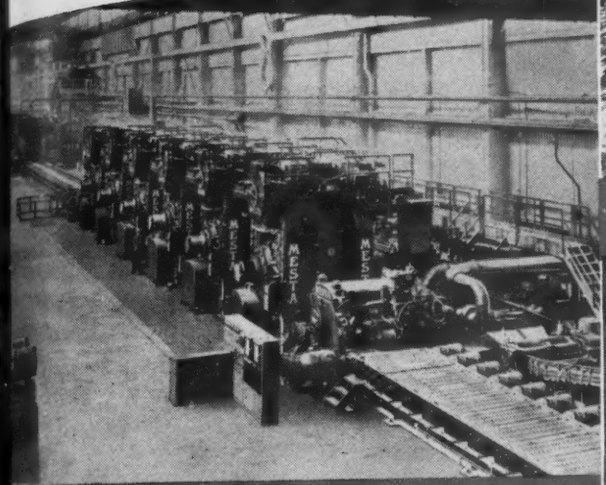
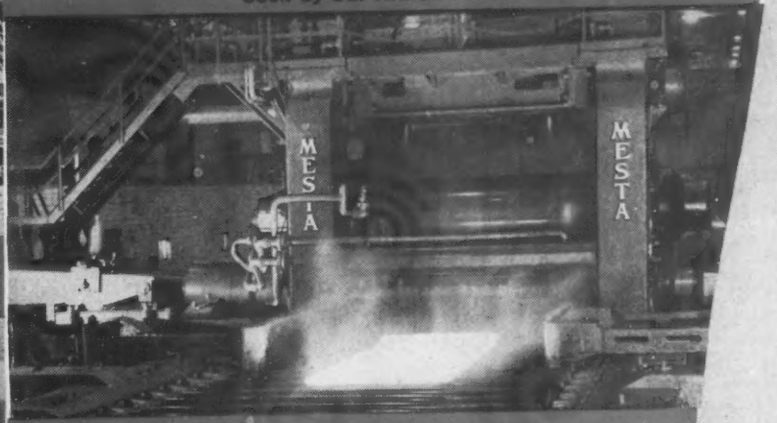


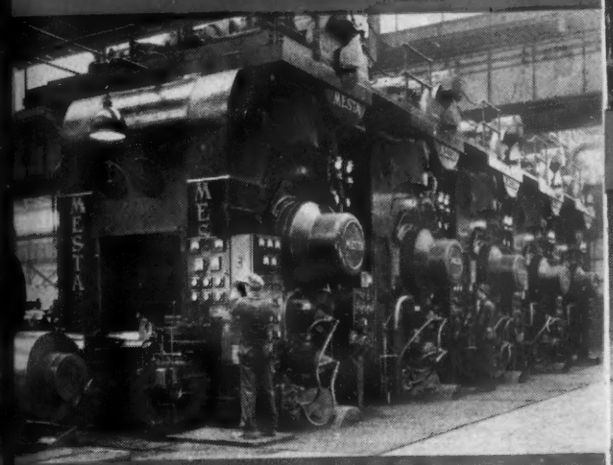
Mesta Produces in a Special Division Great Quantities of Heavy Guns Including the Largest Regularly Used by Our Armed Forces



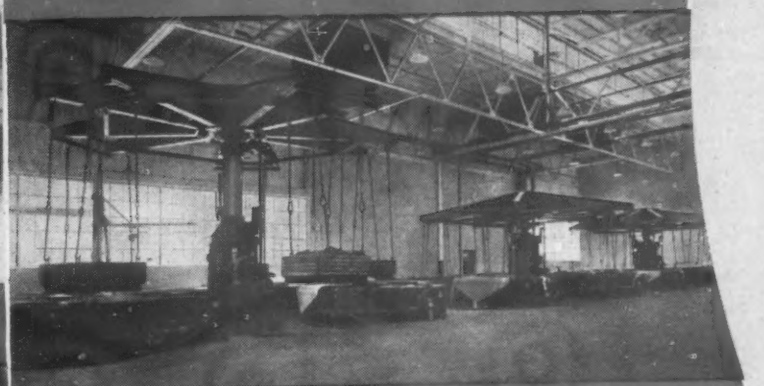
56" Four-High Ten Stand Continuous Hot Strip Mill Designed and Built By Mesta



160" Four-High Reversing Plate Mill Designed and Built by Mesta

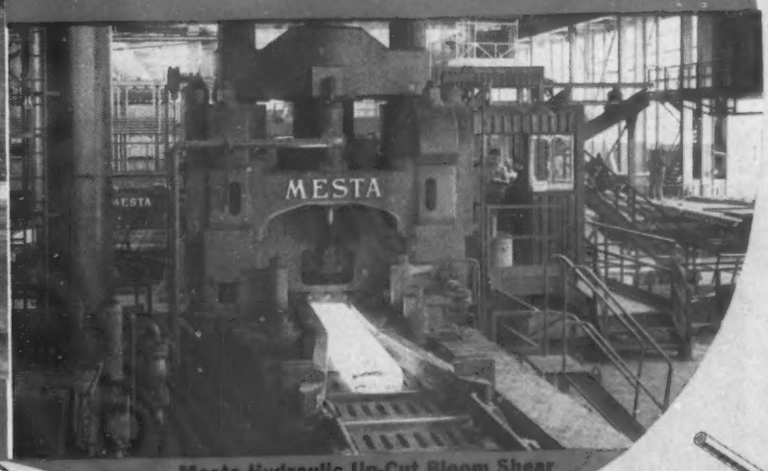


Mesta 42" Five Stand Tandem Cold Mill for Rolling Tin Plate Gauges



32" Mesta Patented Pickling Machines for Pickling Drop Forgings

132" Four-High Continuous Plate Mill Designed and Built by Mesta



Mesta Hydraulic Up-Cut Bloom Shear

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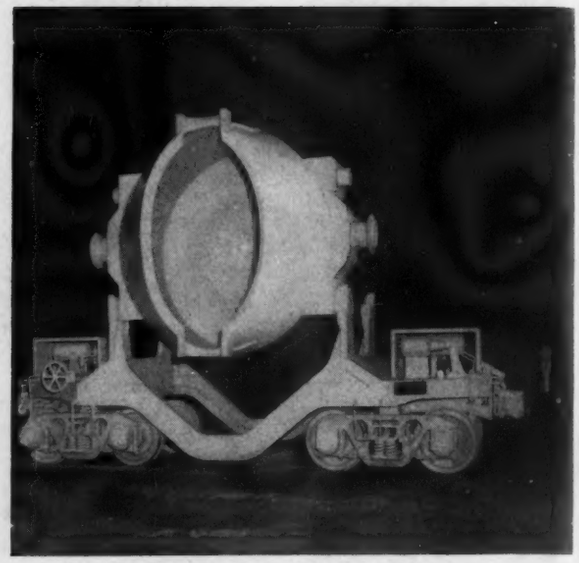
ARMY E NAVY

CINDER CAR



KLING HOT METAL CAR

POLLOCK

HOT METAL CARS *and* LADLES
Kling Heat Retaining Type . Mixer Type
Open Top Type

for

Crane and Motor Dumping

•

CINDER *and* SLAG CARS
Single, Double and Triple Pot

for

Steam, Air, Motor and Crane Dumping

•

WELDED OPEN HEARTH LADLES

•

INGOT MOLD CARS

•

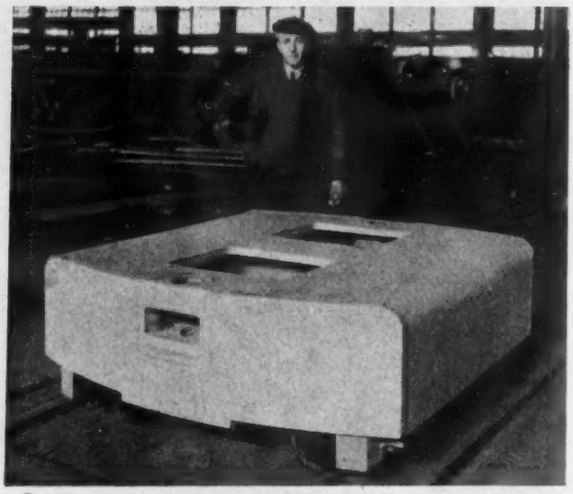
CHARGING BOX CARS

•

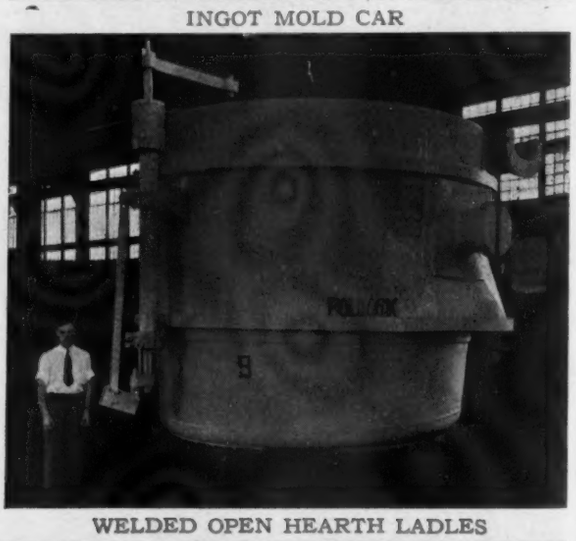
WELDED STEEL PRODUCTS

for

BLAST FURNACES *and* STEEL PLANTS



INGOT MOLD CAR



WELDED OPEN HEARTH LADLES

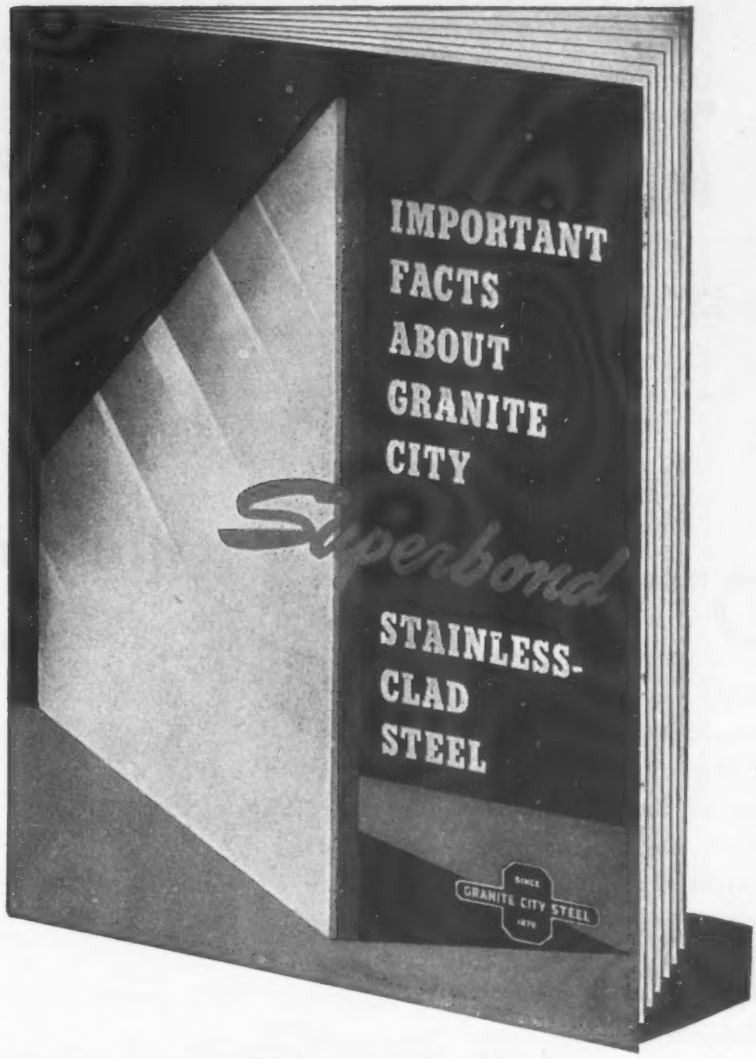
The WILLIAM B. POLLOCK COMPANY

YOUNGSTOWN, OHIO

STEEL PLATE CONSTRUCTION • ENGINEERS - FABRICATORS - ERECTORS

Can You Cash in on the advantages of Stainless-Clad Steel?

Send for This New Booklet Now



Hundreds of Uses for Granite City Superbond Stainless-Clad Steel

—

Acid Tanks • Tubs
Conveyors • Chemical Kettles
Drums • Stills • Fume Stacks
Linings • Pressure Vessels
Tank Cars • Cooking Utensils
Sinks • Cabinets
Storage Tanks of all kinds
Laboratory Equipment
Building Fronts and Trims
Fountain and restaurant equipment • Truck Bodies
Bumpers • Accessories

Facts you will want to know

Both *practical* and *technical,* this Booklet

EXPLAINS the many economical uses of Stainless-Clad Steel.

SHOWS tests of the greater strength of SUPERBOND Stainless-Clad Steel after fracture, severe bending, and drawing.

ILLUSTRATES welding methods.

CONTAINS data on corrosion-resistance to a variety of reagents, and

ANALYZES composition and physical properties of SUPERBOND Stainless-Clad Steel.

TELLS YOU—This Booklet tells the ease with which this type of clad can be formed, punched, beaded, and fabricated. Even extreme drawing jobs can be drawn on the same presses and dies used for mild steel.

IT WILL PAY YOU TO WRITE FOR YOUR COPY OF THIS BOOKLET TODAY!

Granite City Steel Co.

Granite City, Illinois

Chicago • Cleveland
Denver • Houston
Indianapolis • Kansas City • Los Angeles

SINCE
GRANITE CITY STEEL
1878

Louisville • Memphis
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HOT ROLLED SHEETS • COLD ROLLED SHEETS • STRIPLATES • STAINLESS-CLAD • TIN PLATE • TERNE PLATE • ELECTRICAL SHEETS • TIN MILL PRODUCTS • PORCELAIN ENAMELING SHEETS

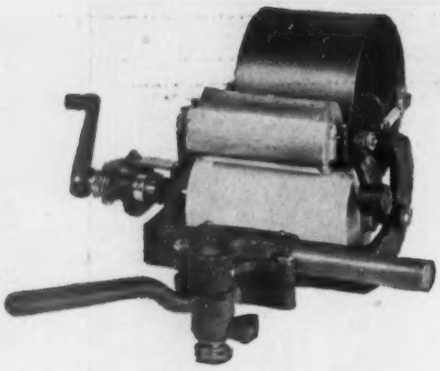

Photo courtesy of Elliott Addressing Machine Co.

——advance by die-casting

die-casting by Advance

DIE-CASTINGS in the assembly shown above typify the vital place die-casting enjoys in metal working. One need not be a technical expert to appreciate the savings effected by die-casting just one of these units—shown at right. These savings include reduction of weight without loss of strength, the coring of holes permitting finished reaming without preliminary drilling, shaft cradle recesses cast to finished dimensions which do not require expensive milling operations, all of which are necessary with sand castings.

Thus Advance die-castings provide safe shortcuts to faster production and higher quality. To Advance engineers intricacy is no barrier to "Quality with economy."

ADVANCE PRESSURE CASTINGS, INC.

ENGINEERS, DESIGNERS AND MANUFACTURERS OF DIE-CASTINGS OF "QUALITY WITH ECONOMY"

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OWEN SCRAP GRAPPLES

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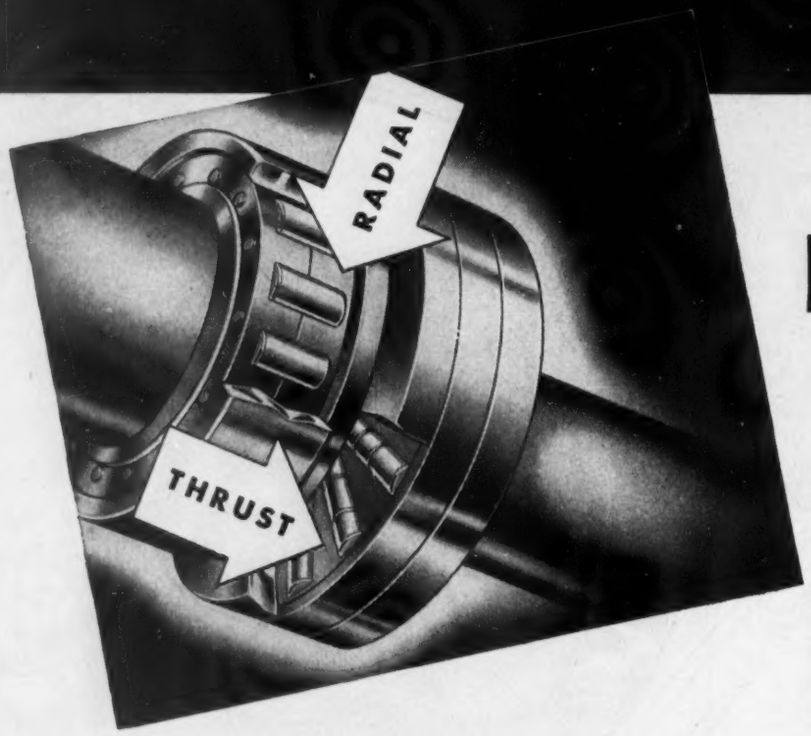
BRANCHES: NEW YORK, PHILADELPHIA, CHICAGO, BERKELEY, CALIF.

Are Bearings the LIMITING FACTOR In YOUR Postwar *Design & Production*



Specify ROLLWAY *Right-Angle* LOADING *for*

1. Longer machine life
2. Greater machine efficiency
3. Less maintenance care

Whether your job is to re-design old products or to develop new ones, it breaks down into two phases:

1. **To design competitive sales appeal into the product; i.e., longer life, higher efficiency, and lower maintenance costs.**
2. **And to design or change-over production machinery for heavier loads, or higher speeds with less time out for service.**

In both of these, bearings are often the limiting factor. That's why Rollway's right-angle loading is so important. Right-angle loading insures that only simple loads are ever brought to bear on a single bearing. It automatically splits compound loads into pure radial and pure thrust . . . carries the radial load on a radial bearing, the thrust component on a thrust bearing . . . *both at right angles to the roller axis*. Oblique loads and their resultants are never introduced.

That means greater carrying capacity in given dimensional limits . . . or higher speed . . . or longer life . . . or proportional combinations of all three. It means lighter, more compact design . . . with firmer control over the distribution of stresses.

•

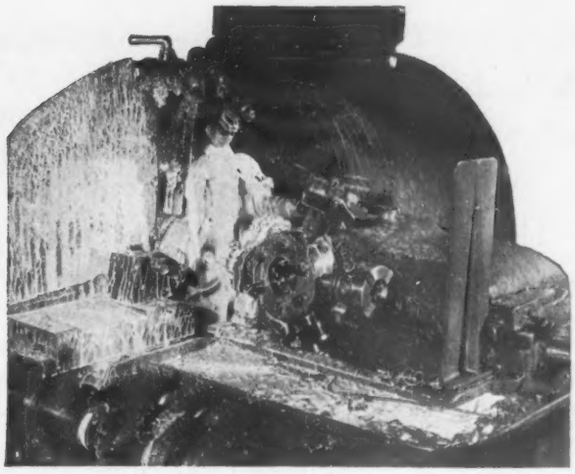
Proper Bearing Selection is a Specialist's Job; Let Rollway Engineers Help You

Just send a drawing or detailed statement of your problem and let our free Advisory Engineering Service help you in selecting the most efficient Rollway Bearings for your new and replacement designs. No obligation.

ROLLWAY BEARING COMPANY, INC., SYRACUSE, NEW YORK

BUILDING HEAVY-DUTY BEARINGS SINCE 1908 **BEARINGS**

SALES OFFICES: Philadelphia • Boston • Pittsburgh • Youngstown • Cleveland • Detroit • Chicago • St. Paul • Houston • Tulsa • Los Angeles



Let Your Production Records Prove Our Claim... PERFECTED LUBE-WELL CUTTING COMPOUND WILL SHOW A PRODUCTION INCREASE PER MACHINE UP TO 25% REGARDLESS OF THE MACHINING OPERATION OR THE MACHINE TOOL BEING USED.

To prove with your figures, on your work, in your plant, that this statement is founded in fact, G. Whitfield Richards will ship you any quantity of Perfected Lubewell Cutting Compound. You will find that it will 1. Increase machine production up to 25%; 2. Increase tool life up to 50%; 3. Give a superior finish and closer tolerances; 4. Lower cutting lubricant cost as much as 40%. We stand ready to prove this claim without obligation. Perfected Lubewell costs from 3 to 9 cents per gallon in the machine. Write today.

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PIONEERS OF *Water Soluble Cutting and Drawing Lubricants*

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Dependable Power that is

Cooper-Bessemer Diesels
serve industry in these ways:

1. Produce power where electric energy cannot be bought economically.
2. Direct-drive high speed pumps.
3. Operate air and gas compressors.
4. Supplement steam plant equipment, where power load is greater than can be economically produced by steam needed for heating or processing requirements.
5. As standby for hydraulic turbines and water wheels in times of low water.
6. Produce electric power on construction work, where semi-portability is desirable.
7. Produce electric power in isolated locations, as at mines and quarries.
8. As standby for central station power.

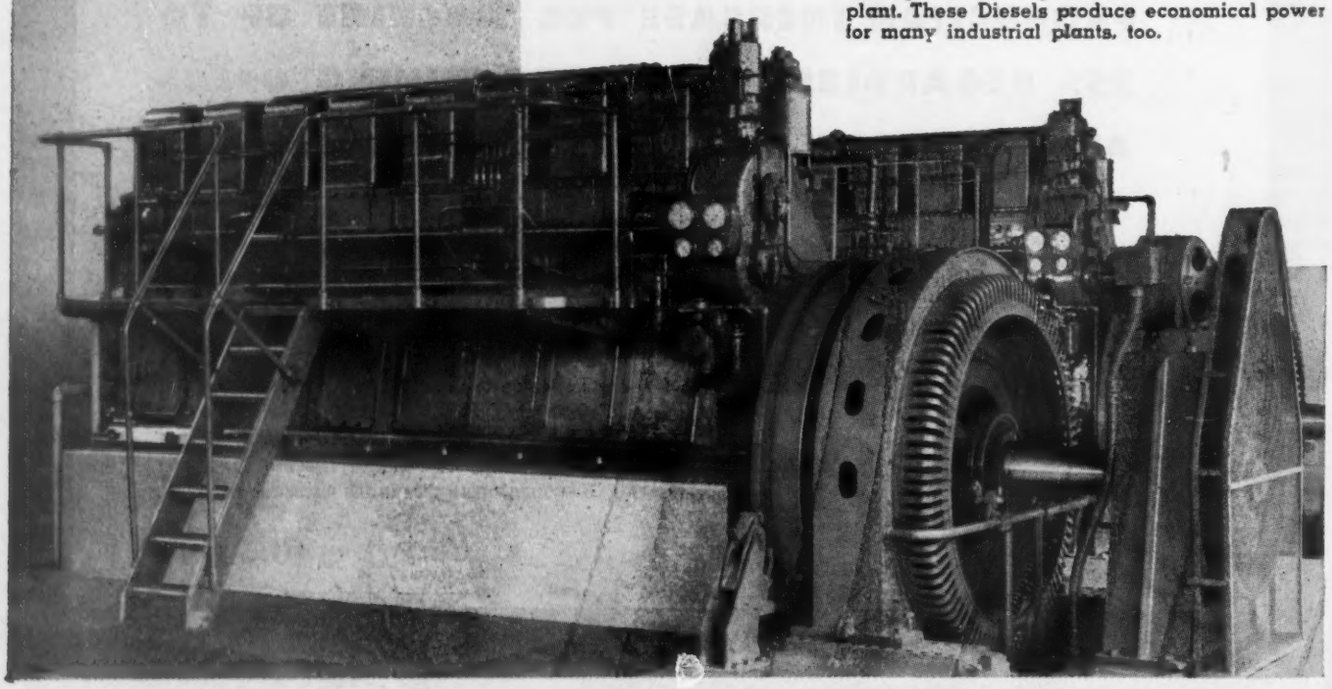
Ask any user of a Cooper-Bessemer why he likes it. Nine chances in ten, he'll mention Dependability—its ability to stay on the job year after year, handling overloads or normal loads without interruption of service, with negligible maintenance or repair.

Such dependable performance means Economy measured in low-cost operation . . . economy further emphasized by fuel saving and efficient work output, resulting from good design, advanced engineering and sound workmanship.

Most Cooper-Bessemer Diesels built since Pearl Harbor have gone into ships for the Navy and Maritime Commission. The hundreds of compressors have gone to such vital war industries as synthetic rubber, aviation gasoline, natural gas transmission, ammonia and helium production and other critical processing operations.

Of course, before the war, Cooper-Bessemer sup-

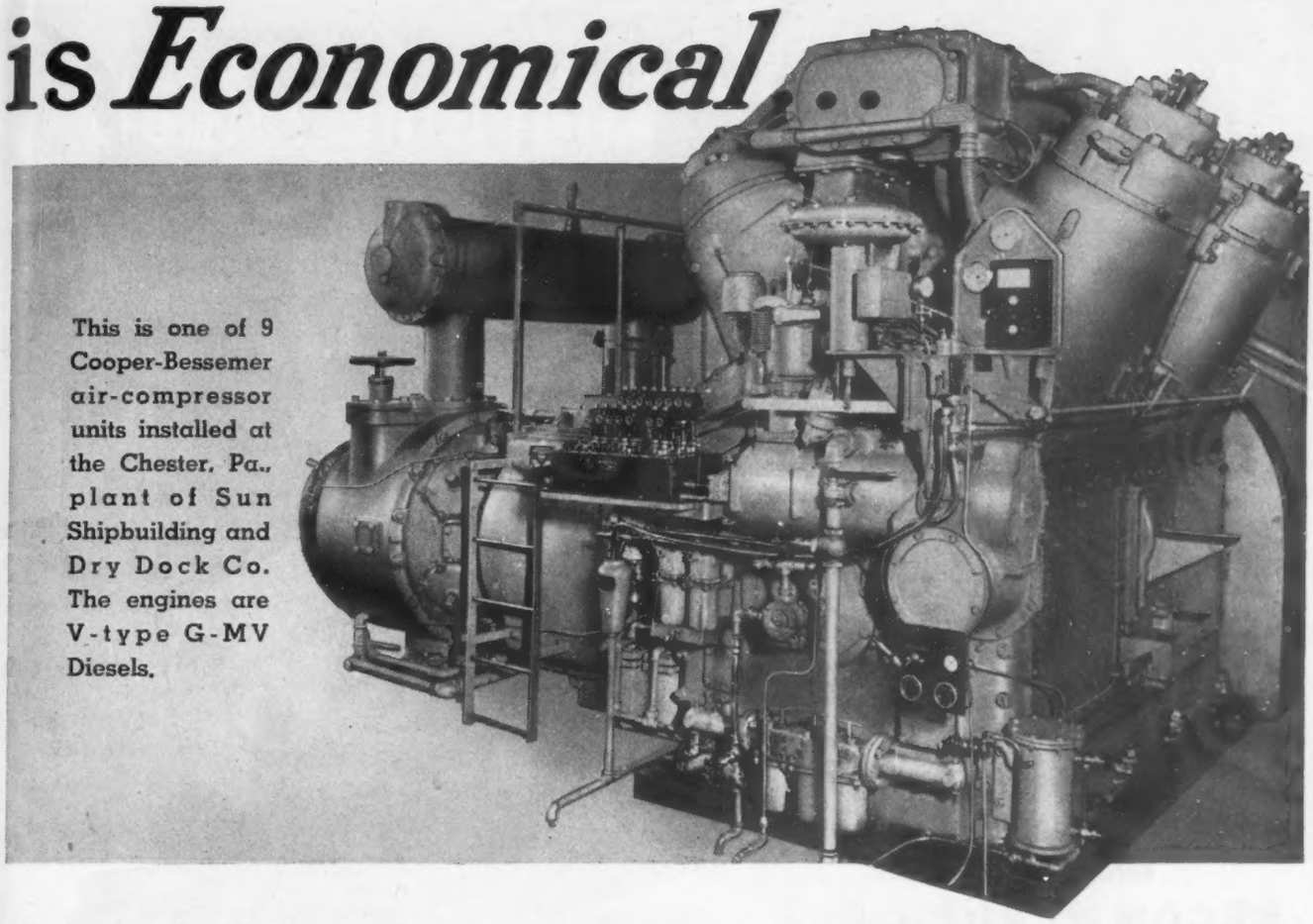
Two JS 8-cylinder Diesels, rated 688 hp. each, driving 493 kw. generators in a municipal plant. These Diesels produce economical power for many industrial plants, too.



DIESEL AND GAS ENGINES

FOR COMPRESSORS, PUMPS, GENERATORS

t is *Economical* . .



This is one of 9 Cooper-Bessemer air-compressor units installed at the Chester, Pa., plant of Sun Shipbuilding and Dry Dock Co. The engines are V-type G-MV Diesels.

plied other hundreds of engines and compressors to industry . . . equipment that continues to perform dependably and economically today, under the heavier loads and trying conditions of wartime, often operated by personnel of little or no experience.

As war demands slacken, we are ready to build even better engines and compressors for industry . . . for our old customers and new ones, too, who want to enjoy the sure advantages of dependable, economical Diesel and gas engines to run generators, pumps, compressors, and other heavy equipment.

It is time now to figure your needs, immediate and post-war. Your inquiry will receive our prompt attention.

Diesel and Gas Engines For Compressors, Pumps, Generators

Type G-MV . . . *Industry's Most Efficient Compressor*

1. Do you supply compressed air in large volume?
2. Must it be available at dependably uniform pressure?
3. Do you want to produce it at lowest cost?

If your answer is Yes, then you'll be interested in the Cooper-Bessemer Type G-MV Air Compressor.

Type G-MV has proved itself in service to be industry's most efficient compressor, because of such unique features as its V-angle design, its use of full pressure lubrication, its sound principle of high-pressure fuel injection and low-pressure air scavenging, and its rugged construction of tough Meehanite metal throughout. It is supplied for either gas or diesel fuel, is easily convertible.

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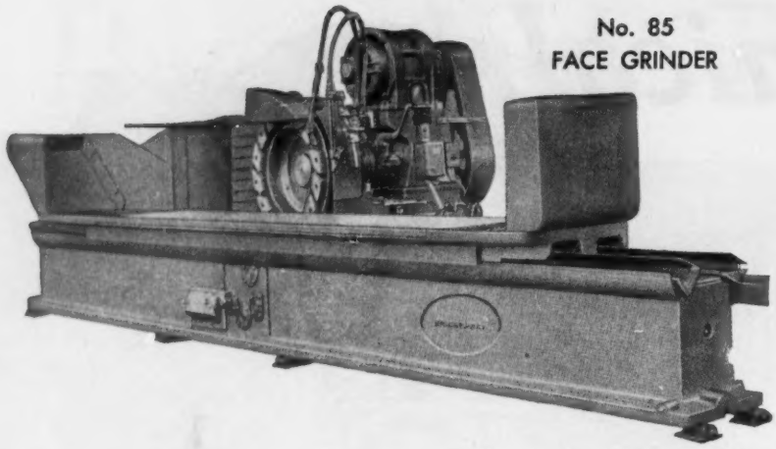
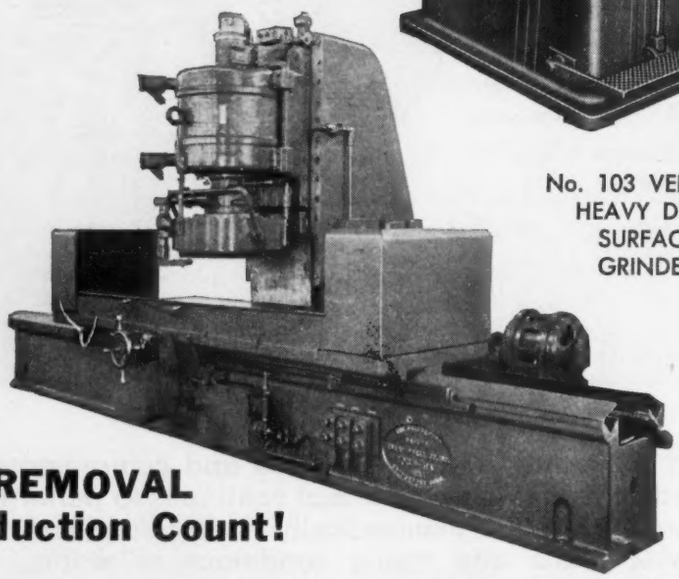


No. 85
FACE GRINDER

No. 47W "ABRASAW"
WET CUT-OFF
MACHINE

No. 161 HIGH SPEED
MOTOR DRIVEN
FLOOR GRINDER



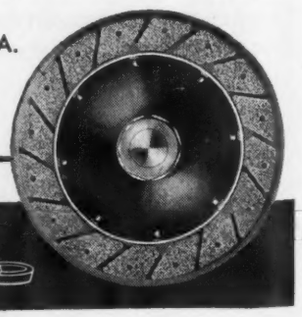
No. 103 VERTICAL
HEAVY DUTY
SURFACE
GRINDER

RECOMMENDED FOR FAST, ACCURATE METAL REMOVAL Wherever Accuracy & Production Count!

In innumerable metal working plants, the technique of metal removal has reached a high stage of excellence through the use of "Bridgeport" Grinders and Grinding Wheels. Wherever speed or an accurate, well-finished job are important, "Bridgeport" equipment demonstrates beyond all doubt that, peace or war, there is no substitute for quality material and expert engineering.

Long-lived, smooth-running bearings, efficient cooling, extreme ruggedness of frame and fittings, convenient location of controls and adjustments—these are just a few of the advantages which have placed "Bridgeport" equipment in many high production industries throughout the U. S. and foreign countries.

THE BRIDGEPORT SAFETY EMERY WHEEL CO., INC., BRIDGEPORT, CONN., U. S. A.



Bridgeport

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NEW YORK STATE
Rudel Machinery Co.
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New York City 17

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E. A. Lynch Mach. Co.
Times Medical Bldg.
Ardmore, Pa.

WASHINGTON, D. C.
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Washington, D. C.

VIRGINIA and N. and S. CAROLINA
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LIGHT WEIGHT HOLLOW STEEL SHAPES FABRICATED FROM .025 STRIP STEEL

The three propeller spinners shown below are examples of spinners made by the MONTGOMERY PROCESS* for the U. S. Army Air Forces.

We are prepare[d] [to] [make] for you any light-weight conical or circ[ular] [hollow] steel shapes, quickly and economically from .0[25] [gauge] [cold] rolled Steel.

The MONTGOMER[Y] [PROCESS] fabrication makes it possible to form these [shapes] and weld the seams so that the entire su[rface] [is] in its virgin state.

A complete engineering and desig[n service] Quotations will be given upon request.

[Holders] of an "Approved" Inspection rating award from the Army Air Forces.

*Patent Applied For

Harry E. Montgomery

METAL Spinning WORKS

WHERE VALVES MUST FUNCTION!

HARD-SURFACE for LONGER LIFE

AVIATION

MARINE

RAILROAD

AUTOMOTIVE

POWER and AGRICULTURE

Wartime service and modern fuels call for Hard-Surfaced Valves to withstand intense heat . . . resist abrasive wear . . . prevent oxidization and to remain hard . . . assuring continuous performance.

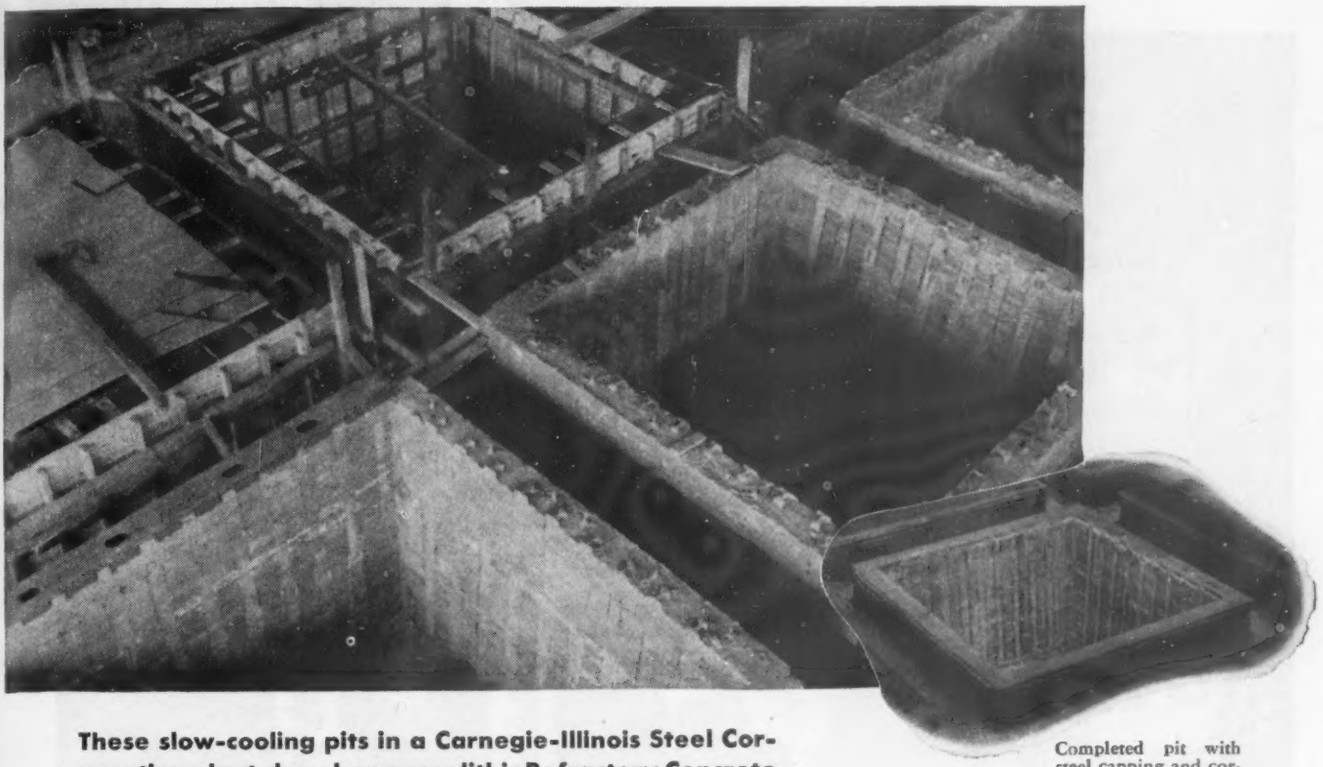
Hard-Surfaced Valves are now included in the postwar plans of many leading engine manufacturers . . . We will promptly quote on your requirements, or if you wish, a Scully representative will call on you.

Scully
HARD-SURFACING
DIV. SCULLY-JONES & COMPANY
1901 SOUTH ROCKWELL STREET ★ CHICAGO 8, U. S. A.

HARD-SURFACING • WELDING • BI-METAL CONSTRUCTION • METALLIZING • FABRICATING • SPECIAL ALLOY CASTINGS

FOR TOUGH SERVICE

Steel Mills Use Refractory Concrete



These slow-cooling pits in a Carnegie-Illinois Steel Corporation plant show how monolithic Refractory Concrete is used to resist wear and tear at high temperatures.

Completed pit with steel capping and corner angles in place

JOB DATA

9 cooling pits: 14′ x 14′ x 6′
Wall thickness: 12″ top, 20″ bottom
Maximum temperature: 1600 F
Concrete: LUMNITE with crushed-firebrick aggregate.
Construction view clearly shows method of building.
Built by Rust Furnace Company, Pittsburgh, Pa.

Refractory Concrete eliminates joints—*and here's a job where that's particularly important!* For, when wall surfaces are smooth, cooling pits are better able to resist the constant abuse attending the loading and unloading of forgings or billets.

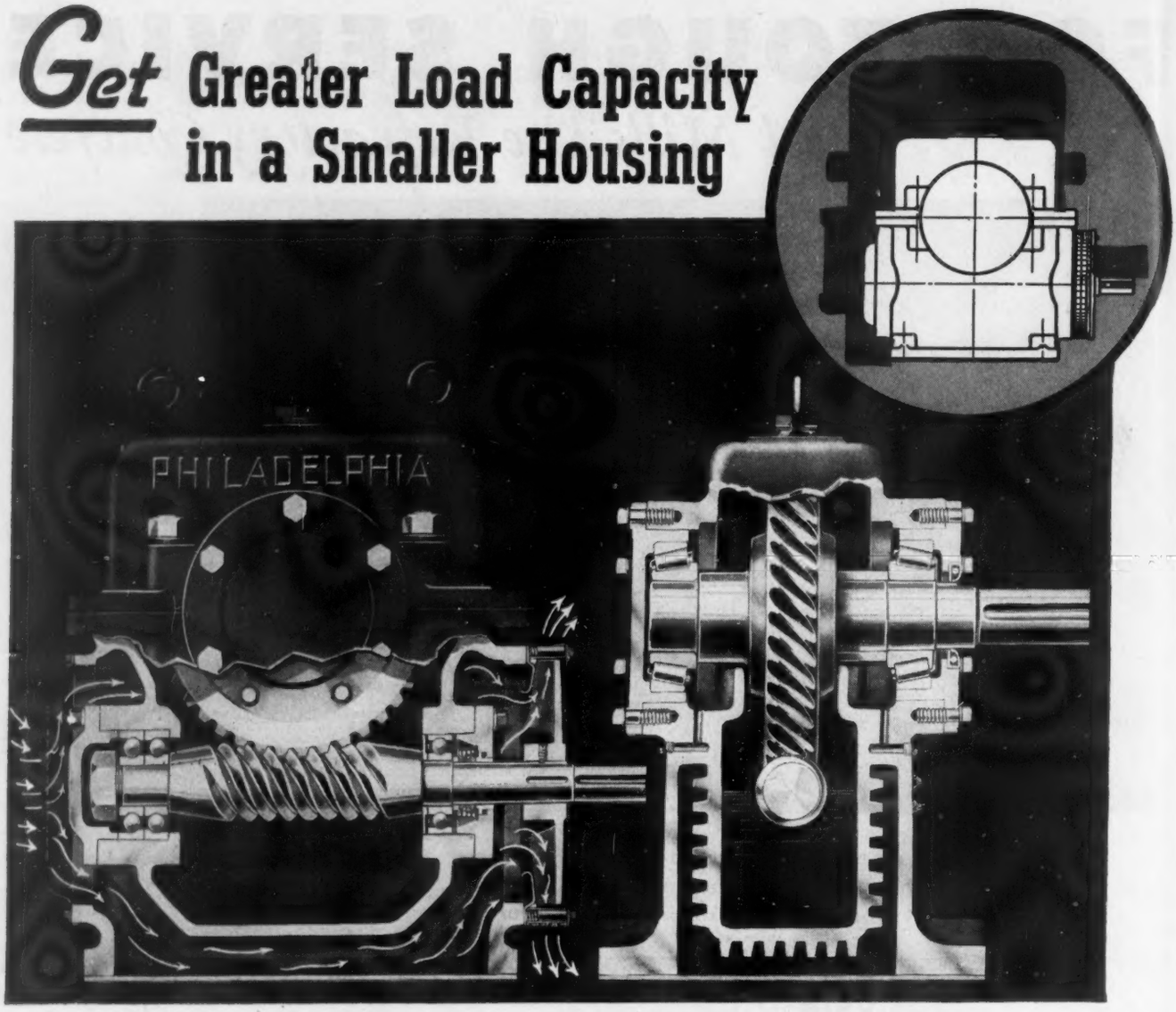
The vertical guard rails are easily and firmly built in, simply by setting them up in the forms and placing the Refractory Concrete around them. There is no trimming of small pieces or daubing with mortar.

Refractory Concrete is made with LUMNITE and firebrick grog, or other aggregate selected to meet your temperature and insulation requirements. Its adaptability makes possible the convenient and economical building of walls, linings and arches, even in hard-to-get-at locations.

This slow-cooling pit installation shows only one of the many ways in which Refractory Concrete is providing fast, economical construction of high-temperature equipment in steel mills. For more information on Refractory Concrete and Refractory *Insulating* Concrete, write The Atlas Lumnite Cement Company (United States Steel Corporation Subsidiary), Dept. S, Chrysler Building, New York 17, N. Y.

LUMNITE FOR REFRACTORY CONCRETE

Get Greater Load Capacity in a Smaller Housing



...with the Philadelphia AIR KOOLED Worm Gear Speed Reducer

At the upper right is shown the comparative sizes of a size 675 Type AT standard unit (in blue) and a size 475 AirKooled unit. Both deliver 20 HP at 1750 RPM. Ratio 4 6/7 to 1.

The cut-away drawings show the double-walled, finned housing and the flow of air around the oil reservoir.

Considerable *space* and *weight* savings have been made possible by the design of Philadelphia AirKooled Worm Gear Reducers as compared with standard heavy duty type worm gear units.

The AirKooled design features a suction fan, mounted on the worm shaft, which draws air through the double-walled, finned housing. This dissipates generated heat, and thereby maintains a higher contact oil film strength and greatly increases the horsepower ratings at worm speeds of 580 and 1750 RPM. For all ratios at 1750 RPM the ratings are approximately doubled, so the AirKooled unit is about two sizes smaller than a standard unit of the same capacity.

Let us tell you what these savings can mean to you.

SEND FOR BULLETIN 250 .... *on your Business Letterhead*

Philadelphia GEAR WORKS INCORPORATED

ERIE AVE. AND G ST., PHILADELPHIA 34, PA. NEW YORK • PITTSBURGH • CHICAGO

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

Here's information you can use, NOW!

New FIBERGLAS* ELECTRICAL INSULATION MATERIAL BOOKLET . . . TELLS WHAT TYPE TO USE, WHERE AND HOW . . .

This free, new booklet will be helpful to anyone concerned with the specification or application of electrical insulation.

It will help you determine which of the many types of Fiberglas electrical insulation materials should be used for a specific job.

The booklet will show you where this better insulation material can be used advantageously for electronic, radio and electrical applications.

It will indicate the ways to use Fiberglas electrical insulation material to obtain all of the benefits which it affords.

Containing complete information about Fiberglas, the new booklet illustrates Fiberglas fibers and filaments twisted into yarns, served on wires, woven into tapes and cloths, braided into sleevings and formed into tying cords.

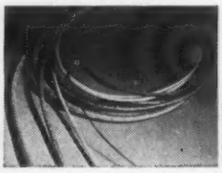
It describes the unique combination of electrically and mechanically important characteristics of Fiberglas such as: high temperature, moisture and acid resistance, favorable space factor and high tensile strength. It shows how the insulating impregnants increase the effectiveness of Fiberglas' inherent characteristics and add others such as high dielectric strength, insulation resistance and resistance to abrasion.

You will see why the use of this basic, inorganic, insulating material is increasing so rapidly—why so many designers, manufacturers and repair shop operators prefer it.

Be sure to have a copy of this new booklet in your file for ready reference. Write for your copy today —there is no obligation. Address: *Owens-Corning Fiberglas Corporation, 1873 Nicholas Building, Toledo 1, Ohio. In Canada, Fiberglas Canada Ltd., Oshawa, Ontario.*

Fiberglas varnished cloth and tape

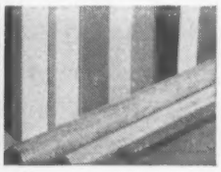
Fiberglas insulated wire



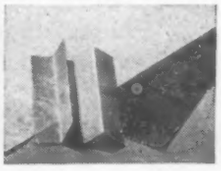
Fiberglas tying cord

Fiberglas saturated sleeving and varnished tubing

Fiberglas laminated plastics



Fiberglas-mica combinations



FIBERGLAS

*T. M. Reg. U. S. Pat. Off.

ELECTRICAL INSULATION MATERIAL

Galvanized Metal Buildings for Troops in Iceland

★ In every part of the world today, galvanizing, or zinc coating, protects our fighting men and equipment . . . for the U. S. Bureau of Standards has pronounced zinc "by far the best" metallic coating for the protection of iron and steel against rust. Tomorrow zinc will play an equally important part in the protection of America's peace-time products.

EVERY GRADE OF ZINC FOR WARTIME REQUIREMENTS

PRIME WESTERN

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AMERICAN ZINC SALES COMPANY

Distributors for

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COLUMBUS, OHIO CHICAGO ST. LOUIS NEW YORK

Announcing the

DOEHLER-JARVIS CORPORATION

A corporation created by the consolidation on January 1, 1945 of

DOEHLER DIE CASTING CO.

and

W. B. JARVIS COMPANY

DOEHLER DIE CASTING CO. will function as heretofore but under the name of Doehler Die Casting Division of Doehler-Jarvis Corporation.

W. B. JARVIS COMPANY will function as heretofore but under the name of Jarvis Division of Doehler-Jarvis Corporation.

This consolidation presents the opportunity to our customers to purchase finished and assembled castings as a complete unit and as the product of the combined efforts of both organizations.

MR. H. H. DOEHLER, the founder of Doehler Die Casting Co. is its Chairman of the Board of Directors.

MR. L. A. JARVIS, the former President of W. B. Jarvis Company, is its President.

The established reputation of the Executive Staffs of both companies and the known high quality of their products will be more than ever zealously guarded and maintained.

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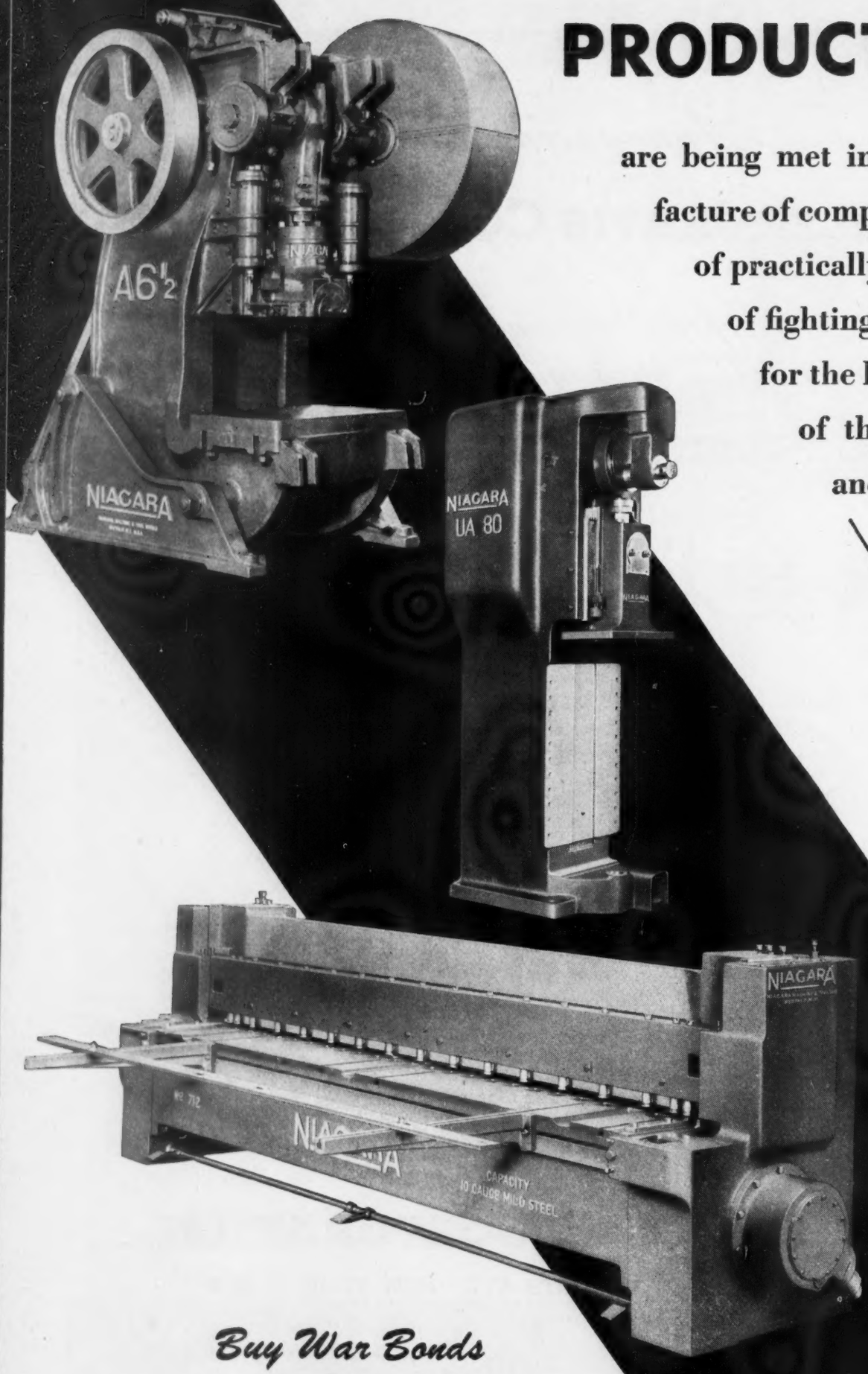

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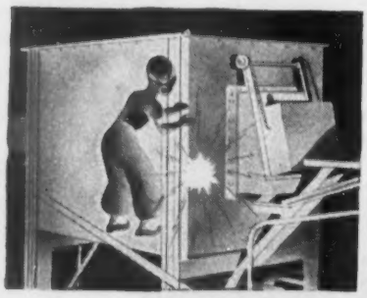
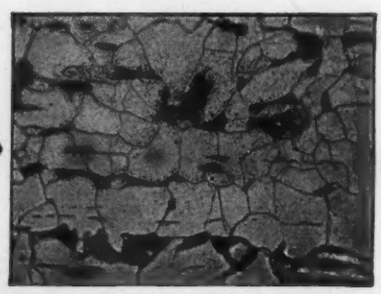


ARROWS INDICATE JOINT

This is a Photomicrograph (500 Diameters) of a perfect copper brazed steel to steel joint. Note individual crystals formed half on one side of the joint, half on the other. Metallurgically, the joint no longer exists. (Brazing done in Salkover Metal Processing Chicago plant).



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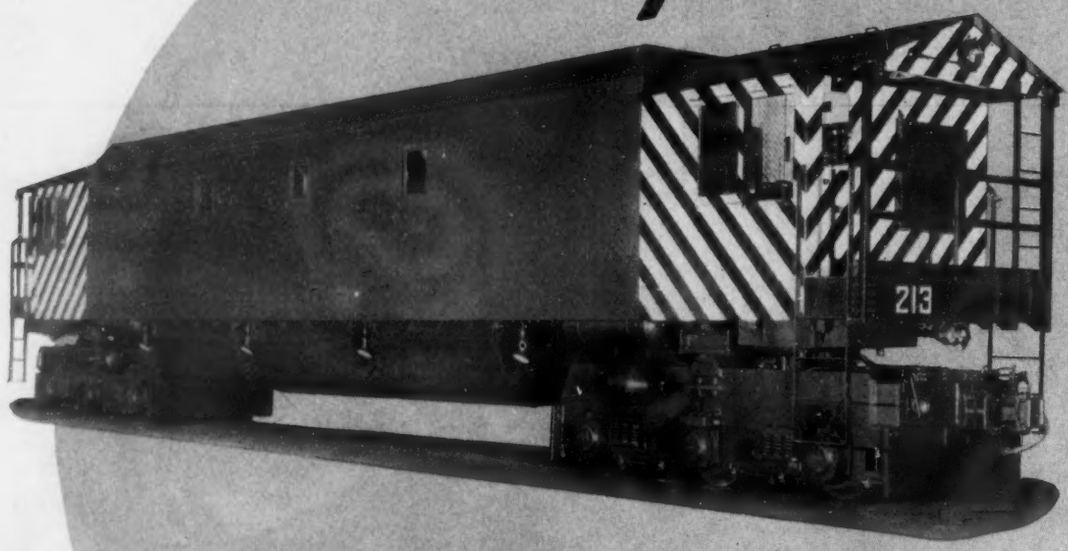

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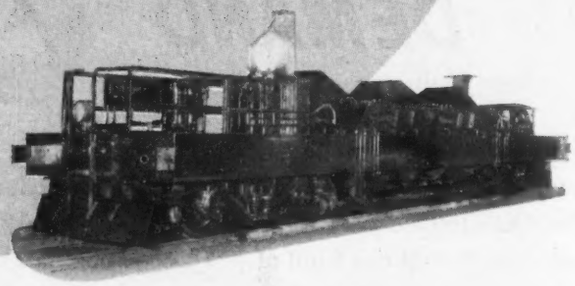

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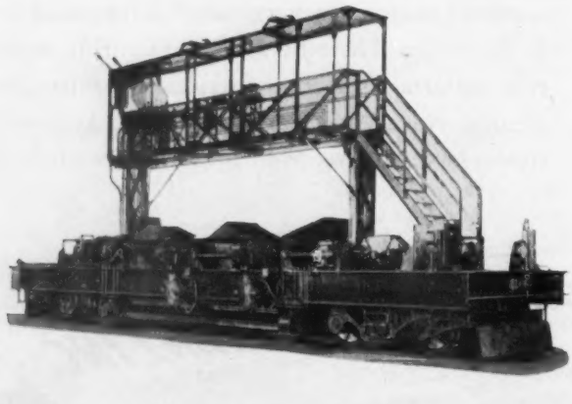

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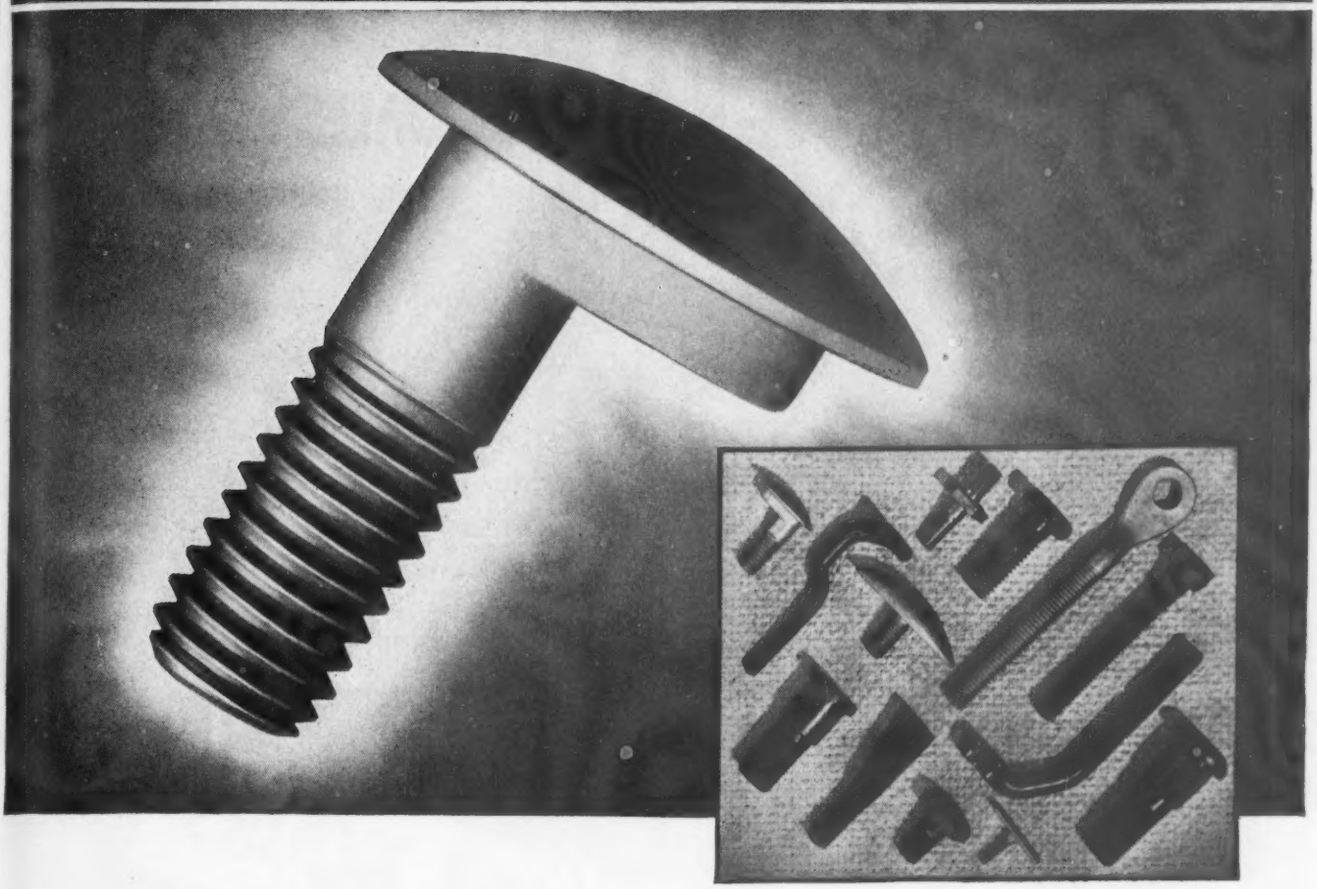

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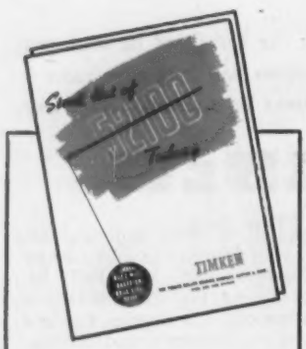

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MARINE DIESELS

are produced for new Victory Ships under noteworthy efficiency at the Nordberg Manufacturing Company plant, through whose courtesy this photo was obtained. The setup illustrated —showing a Super Service Radial in action—calls for a number of operations on Diesel engine beds. Six cored holes around each crankshaft bearing are drilled, reamed and backfaced . . . similar operations are performed on four cored holes between finished ends. Some of the holes are as large as 4" dia. by 23" in length; all are within close tolerances—attesting to the capacity, accuracy and convenience of the Super Service Radial in heavy duty war production.

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SUPER SERVICE RADIAL

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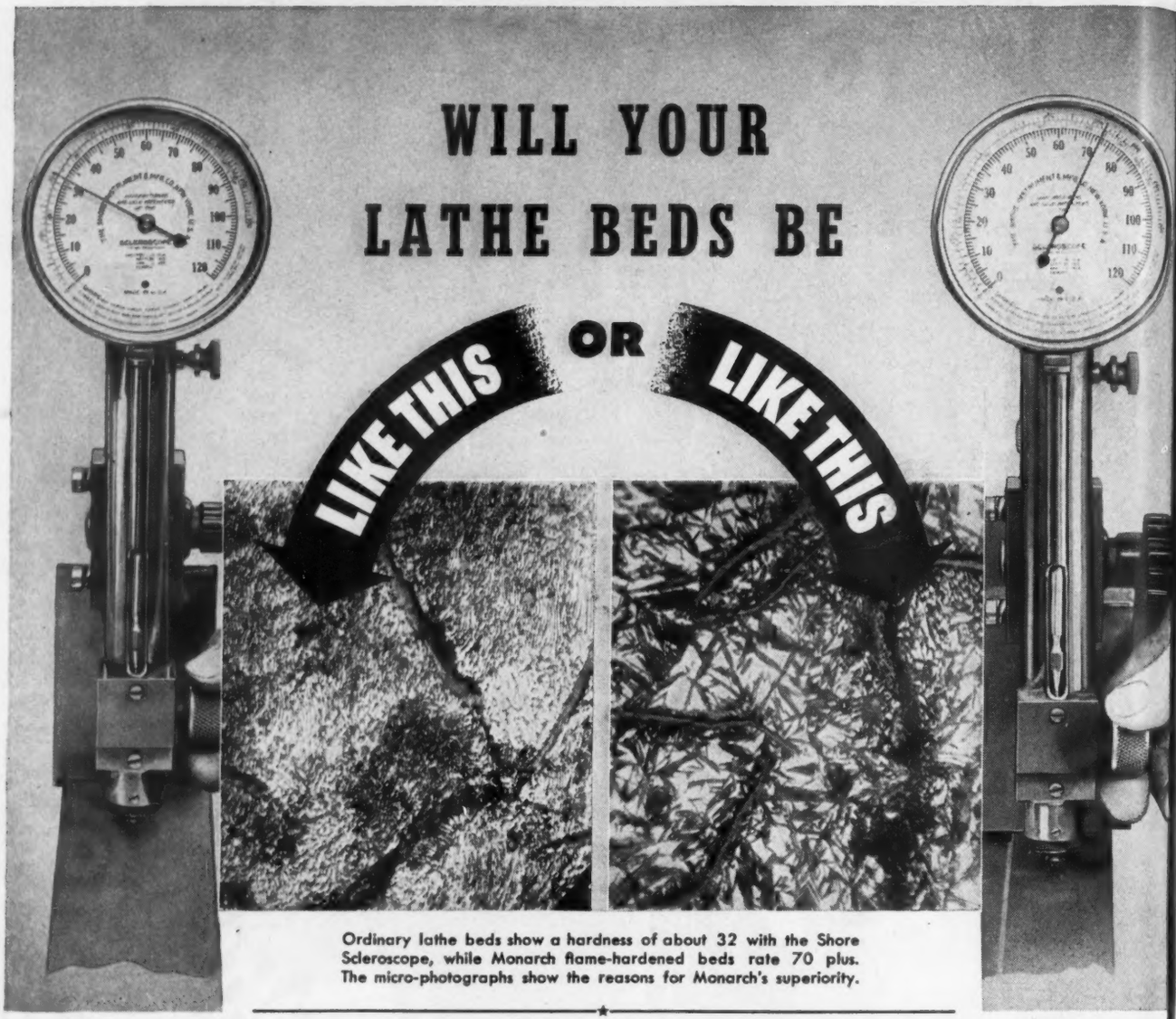

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STEEL

The Magazine of Metalworking and Metalproducing

JANUARY 1, 1945

Volume 116—Number 1

1945 Yearbook of Industry Issue

Price $2.00 per copy

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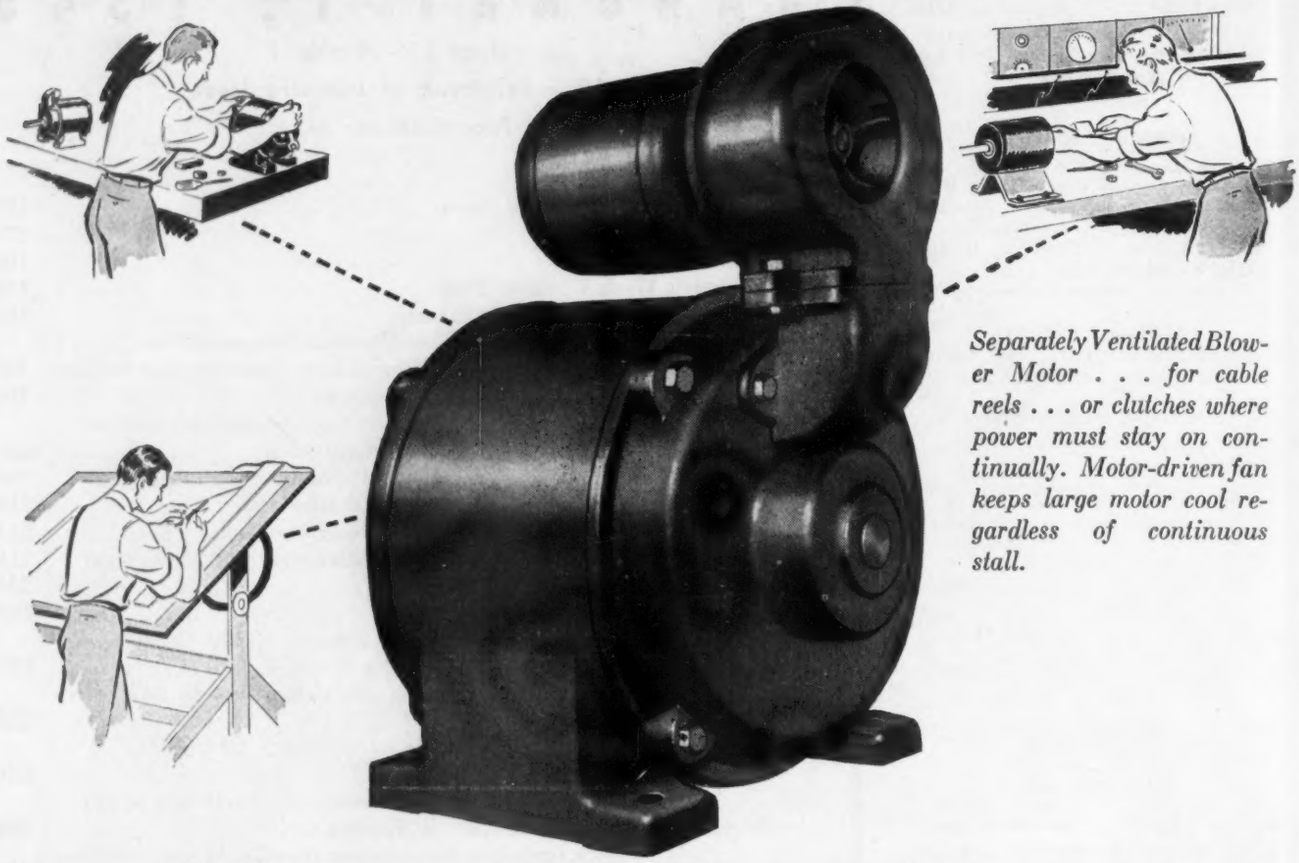

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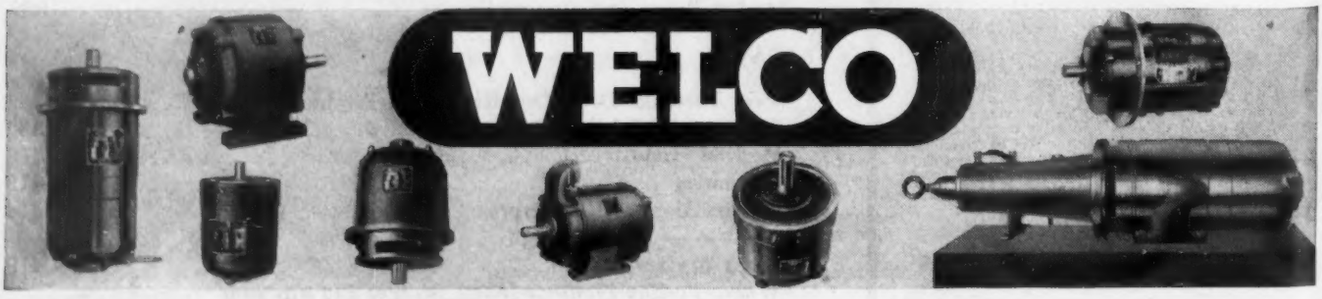


STEEL
January 1, 1945

New Year's Day, 1945!

Some people think that New Year's day is an appropriate time to check one's bearings, calculate one's position and chart a course for the ensuing 12 months. If this practice is good for an individual, it ought to be beneficial for a nation. Particularly it ought to be helpful to our United States of America, whose 135,000,000 citizens at the moment are somewhat confused and disillusioned.

If we will check our bearings carefully and honestly, we will be forced to admit that we are off our course. Our position is not what we thought it was or what it should be. If we will check farther, to see where we made our mistake in reckoning, we will find that it was due to gross carelessness, over-optimism, smugness, complacency and, worst of all, a terrific national conceit.

The cold fact is that we went into this war with the idea that we are a nation of supermen, that we can do anything better than any other nation can do it and that we are so great in every respect that we could wage the war with one hand tied behind our back, so to speak. With this inflated conception of our prowess, we laid plans on a grand scale and executed them in a highly creditable manner. Actually, we did a job that no other nation could have done.

But good as the job was, it could have been better. We never went all-out for war. All the time we were doing marvelous things on the battle fronts and on the home fronts, we also were indulging in experiments, reforms and numerous other distractions. Also, beginning about a year ago, we thought we had done enough to insure winning the war and we began to relax. We were too cocksure of early victory.

Now things are not going too well. We are suffering an unexpected—although perhaps a temporary—setback on the western front. Our muddled foreign policy is backfiring. Our domestic situation is confused. Our people are puzzled. We are beginning to find out that we do not know all the answers.

Painful as it is to admit mistakes and to be disillusioned, the experience ought to teach us a lesson. Profiting from it, let us find out exactly where we are, chart a new and truer course and keep at it with determination until we have reached our goal.

LABOR'S ASCENDANCY: Outstanding among the events of 1944 was the rise of union labor to a position of commanding authority in the shaping of national policy. No matter how much one may question the propriety of the methods employed and no matter how much labor itself later may regret its political alliance in retrospect, the fact remains that the strong voice of union labor will be reflected in legislation, executive orders and other instruments of federal authority throughout 1945 and beyond. Practically everything industry does in the near future will be done in accordance with federal regulations which bear the unmistakable imprint of labor union influence.

While the prospect of back-seat driving by labor has its unpleasant aspects, there will be compensations. For one thing, union labor cannot participate importantly in government administration without assuming definite responsibilities. Until now the labor movement, under New Deal coddling, has

(OVER)

been somewhat arrogant and not too responsive to public criticism. From now on, the more labor dictates national policy, the more labor will be held responsible for the results of these policies.

If labor's ascendancy forces it to assume responsibility commensurate with its authority, industry may be relieved gradually of the consequences of reckless and irresponsible labor action. —p. 184

• • •

TECHNICAL PROGRESS: No one can read the comments of the 175 authorities who have contributed to STEEL's annual survey of engineering progress without realizing that industry is being enriched with new ideas, materials, equipment and processes at an unprecedented rate. Operating blast furnaces under pressure, using basic brick in open-hearths, rolling steel under tension, producing steels with predetermined hardenability qualities, automatic heat-treating by induction, high-speed milling, surface treating by shot peening and scores of other developments and refinements testify to the present accelerated pace of technical progress.

However, the abundance of new "know how" should not cause us to be complacent. In almost every field of engineering activity, the number of problems remaining to be solved exceeds that of problems already solved. A study of the comments of the experts and of STEEL's "Technical Work Sheet for 1945" will show that metallurgists, engineers and other technicians can look forward to an exceedingly busy year. —p. 254

• • •

WORK SHEET FOR 1945: A year ago industrialists looked forward to 1944 as a year which might witness a gradual tapering off of war production and the resumption of civilian goods, manufactured on a limited scale. The events of war knocked this expectation into a cocked hat.

Today, one views the prospect more realistically. War may require the full effort throughout most of the year, or an early turn in the tide of war may permit a shift to civilian pursuits earlier than now is expected. But whatever the year brings forth, management knows that beyond the first job of producing for war lies a long series of adjustment problems, which will entail a tremendous volume of work. Perhaps much of this work will fall in 1945.

On this assumption we have prepared a work sheet of things to be done by industry in the current year. It is an impressive agenda, in that it emphasizes the great variety of problems with which industrial management may be confronted during 1945. —p. 182

SHARP TURN TO LEFT? While we in America are conscious of a minority movement toward socialism, we do not consider it a serious or imminent threat. However, in England and on the Continent the issue has become so acute that industrialists are deeply concerned about the fate of private enterprise.

Discussing this situation, Vincent Delport, European editor of STEEL, points out that in every warring nation the government has concentrated in its hands many controls affecting industry and trade. Defenders of unlimited state control believe the system serves the interests of democracy by erecting barriers against "vested interests" and by insuring a more just distribution of goods among the less fortunate people.

British labor would like to see Britain nationalize coal mining, steelmaking, public transport, banking and insurance. The French government has taken over the Renault plants and some coal mines. Whether these are temporary or permanent measures, the fact remains that the trend abroad is alarmingly in the direction of public ownership and control. —p. 302

• • •

PAYS TO BE PROMPT: There are numerous details in connection with war contracts which should be cleared up as promptly as possible, regardless of the status of war programs.

For instance, it is reported that many contractors fail to realize the importance of doing everything possible to facilitate the prompt termination of contracts. At an earlier date there was a similar complaint that contractors were slow to act in contract renegotiation matters.

Of course it is realized that government representatives are not always as prompt as may be desired. Nevertheless prompt contract termination is good business on two scores. First, if a war production crisis exists, quick contract settlement permits the contractor to turn quickly to new war orders. Secondly, if opportunities for reconversion are in the offing, it clears the way for the resumption of civilian goods manufacture.

These advantages should encourage executives to study the procedure and be prepared to act promptly. —p. 188

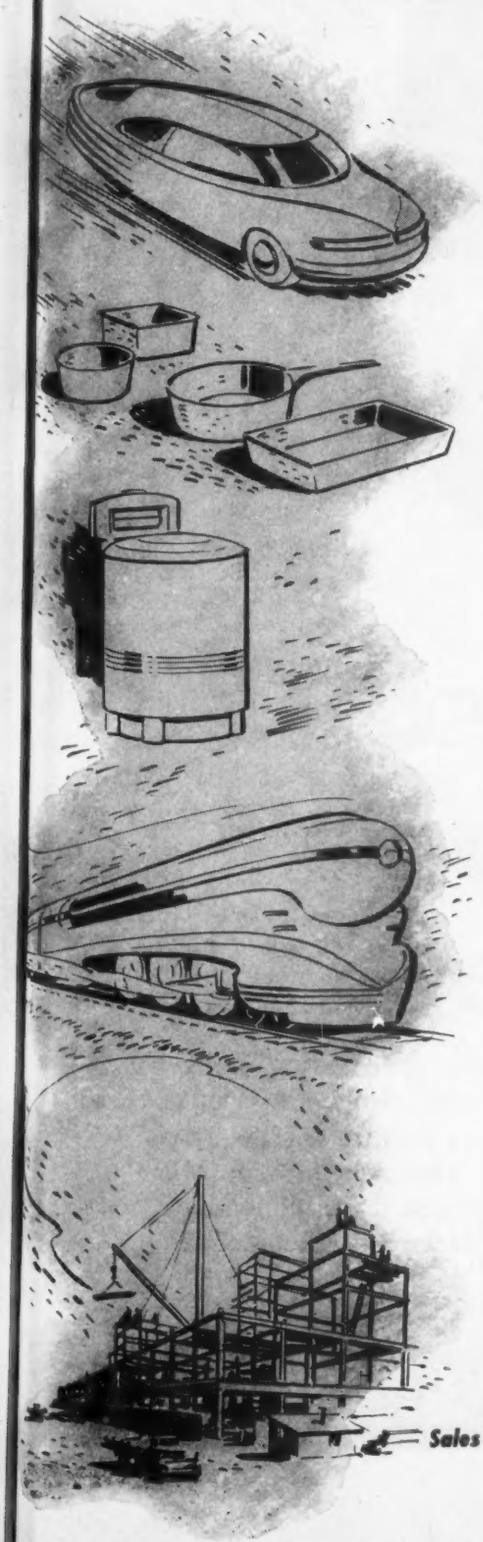
• • •

E. L. Shaner

EDITOR-IN-CHIEF

Design—

For Safety and Dependability With Inland Steel



The buying public has learned to associate steel with safety and dependability. People ride in steel trains over steel rails, live and work in structures made strong with steel, travel the highways in steel automobiles, cross streams on bridges of steel, farm and manufacture with steel equipment, use steel furniture and innumerable household appliances—all with the knowledge that these things, made of steel, cost less, are more durable—have greater strength and safety.

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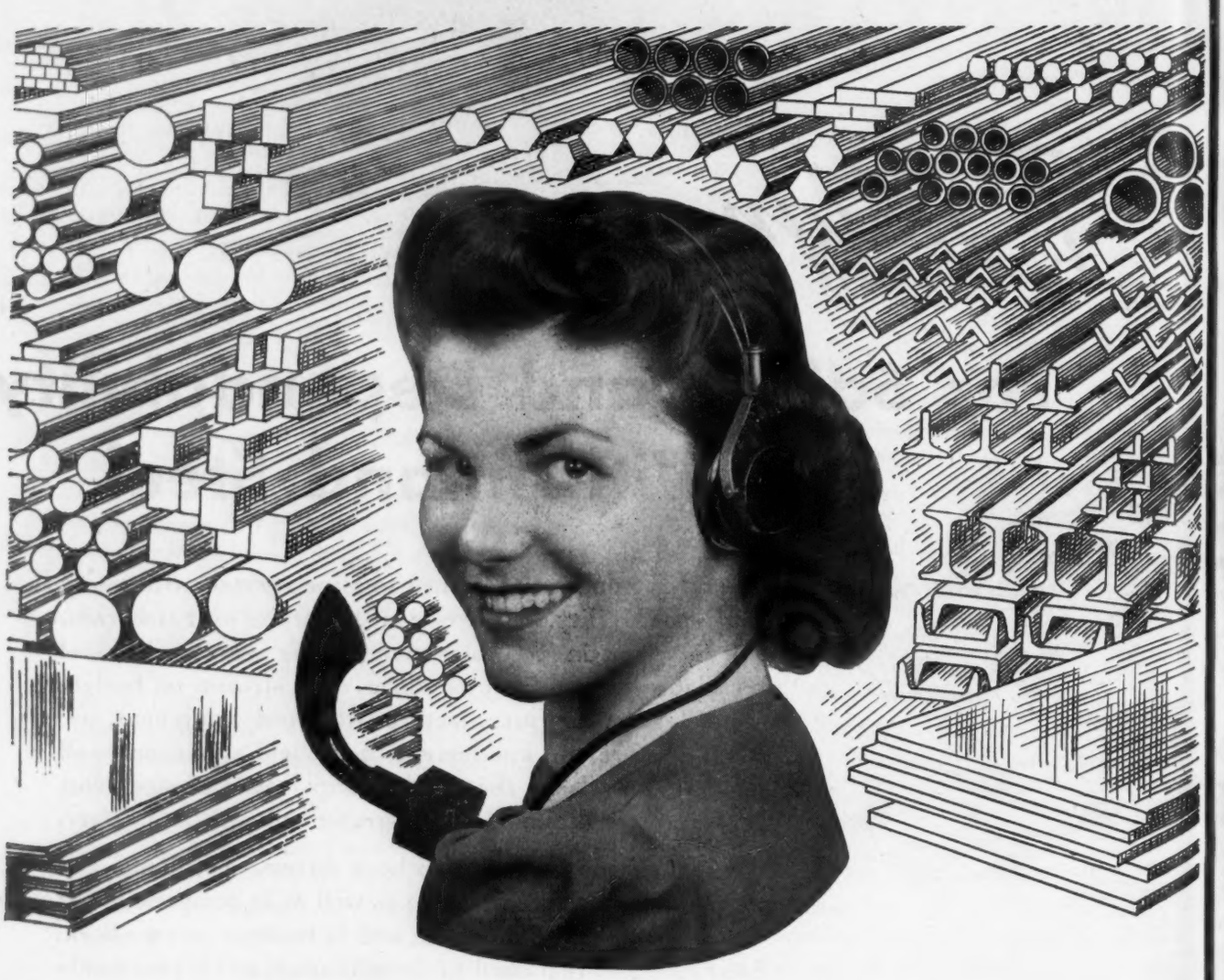

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—PAUL G. HOFFMAN, Chairman
Committee for Economic Development

FOREWORD

SOBERING experience is forcing this nation into a belated appreciation of the realities of global war. Every citizen views the prospect of 1945 with feelings quite at variance with those with which he looked forward to 1944, a short 12 months ago.

From the standpoint of American industry, the contrast is particularly noticeable. A year ago informed men in industry and in government were convinced that America's "arsenal of democracy" was adequate to meet any conceivable requirements of war. Munitions production had reached a peak in November, 1943, and the authorities believed that continued output at high levels soon would fill every supply line to the battlefronts to overflowing and that early in the new year of 1944 this would permit cutbacks in certain war production programs.

This prospect stimulated interest in reconversion and postwar planning. Government officials, industrialists, labor leaders and others all concurred in an unwritten policy that we continue war production at levels high enough to meet any predictable requirements and that at the same time we gradually shift facilities not required for war to the resumption of some of the most urgently required civilian goods.

Sensing the almost universal approval of this policy, the editors of STEEL, in planning for the Jan. 3, 1944, Yearbook of Industry Issue, decided to mould its editorial content to the theme "Industry at War Prepares for Peace." Under this heading we presented data indicating the impact of war upon steel, the material; steel, the industry; steel, its distributing facilities and steel, its consuming markets. In short, we tried to portray the conditions under which the iron, steel and metalworking industries were to complete their war work and were to move into the problems of the transition and postwar periods.

Today, as we cross the threshold into 1945, the national attitude has been altered sharply. The emphasis on war production has been intensified; that on reconversion and postwar plans subordinated. Now the disposition in almost every center of authority is to put first things first and to be more practical and realistic in every phase of our national program.

We believe this down-to-earth attitude is general through industry. We also believe that Paul G. Hoffman's classic admonition, "Take your hat off to the past and your coat off to the future," is a slogan that most industrialists will accept heartily—particularly in view of what has occurred at home and abroad during the past month. If we sense its current mood correctly, industry is fed up with dreams, promises, wishful thinking and Pollyannish planning. It desires to produce enough or more than enough munitions to make sure there will not be unnecessary recurring production crises in the future. It wants to finish the war job as soon as possible and to move into other problems as rapidly as circumstances will permit. It wants to know

the dimensions and the character of the work which lies ahead.

In line with these desires, the editors of STEEL have prepared for its 1945 Yearbook of Industry Issue a check list of important jobs to be done. "Industry's Work Sheet for 1945", as presented on pages 179 to 219, inclusive, and on page 254 and following pages, is offered as a general outline of the more important problems likely to be encountered by most typical industrial companies in the near future.

Listed among the items of work are the various phases of production for war, renegotiation of contracts, termination of contracts, reconversion—interim and full-scale, disposal of war plants, disposal of surplus equipment and material, manpower adjustments, rehiring and rehabilitating war veterans, improving production methods, continuing industrial research, promoting efficiency, reorganizing sales staffs, analyzing markets, re-establishing distribution channels and improving labor relations and public relations.

In the case of each item of work, its status as of Jan. 1, 1945 is indicated and the objectives for the year outlined. The work sheet emphasizes in an impressive manner the great volume and diversity of industry's 1945 job.

Coats off to these tasks now will mean that a year from now hats can be taken off proudly to the achievements of what may easily prove to be management's busiest year. —The Editors

MEETING SPECIFICATIONS OF INDUSTRY'S WORK SHEET MAY MAKE 1945 MANAGEMENT'S BUSIEST YEAR

INDUSTRY'S WORK

WORK TO BE DONE	NATURE OF WORK	STATUS, JAN. 1, 1945	OBJECTIVES IN 1945
WAR PRODUCTION (a)	Maintaining schedule of general war production program	Munitions index 115 (peak was 118 in March, 1944)	Meet requirements as outlined latest projection of war (p. 246)
WAR PRODUCTION (b)	Meeting production crises as they arise in European war	Critical situation in heavy ammunition, tires, etc. (p. 187)	Lick present critical situation promptly, be prepared to tackle others until V-E day
WAR PRODUCTION (c)	Meeting production crises as they arise in Jap war	No serious bottlenecks in sight	Keep plugging until V-J day
RENEGOTIATION OF CONTRACTS	Bargaining with government on prices	Majority of cases settled satisfactorily; a few disputes still unsettled	Clear dockets of renegotiation c to speed war production and to ready for reconversion
TERMINATION OF CONTRACTS	Settling accounts with government to free facilities for other work	Of $23 billion in terminated contracts, $10 billion have been settled, $13 billion are pending	Speed termination procedure (1) facilitate war production; (2) to cl for reconversion when permissi (p. 188)
INTERIM RECONVERSION	As war orders run out, shifting released facilities to civilian goods manufacture	WPB plans held in abeyance. Civilian goods programs frozen at fourth-quarter levels. (p. 192)	When war situation permits, exte interim reconversion to gain expe ence for full-scale reconver later
DISPOSITION OF WAR PLANTS	Raze, close, sell, lease or operate plants not needed for war	Few plants idle as yet; some listed for sale or lease when war work ends	For government, define policy; industry, decide what plants fit postwar picture. (p. 189)
DISPOSAL OF WAR SURPLUSES	Liquidating surpluses with minimum shock to national economy	Preliminary work of Clayton office gathers dust as new board prepares to take over	Buy surpluses when they can used advantageously. (p. 189)
FULL-SCALE RECONVERSION	Planning for big-shift after V days	Numerous companies have step-by-step plans ready (p. 191)	Revise plans to keep step w changing conditions. Be ready wars end suddenly
F-S RECONVERSION—MATERIALS	Adjusting operations to unrestricted materials	Few opportunities have arisen	Compare merits of wartime sub tutes with materials available plan accordingly
F-S RECONVERSION—FACILITIES (a)	Clearing plants of wartime equipment	Little has been or could be done	Plan for this contingency careful In some plants it is of primary portance
F-S RECONVERSION—FACILITIES (b)	Equipping and tooling for peacetime	With limited exceptions, nothing has been done	File reservation for needed equ ment and accessories
F-S RECONVERSION—MANPOWER	Adjusting personnel from wartime to peacetime basis	Problem has not arisen (p. 193)	Anticipate exodus and influx workers. Prepare for orderly shi
REHIRING WAR VETERANS	Adopting plans to assure fair deal for returning servicemen	Probably less than third of employers have adequate plans in operation	Perfect existing plans and exte them to all plants so industry w be ready when big rush com (p. 193)

SHEET FOR 1945

WORK TO BE DONE	NATURE OF WORK	STATUS, JAN. 1, 1945	OBJECTIVES IN 1945
REHABILITATING VETERANS	Helping handicapped men to prepare selves for jobs	Government and few larger employers are tackling problem energetically	Extend rehabilitation so that proper facilities will be available when needed (p. 193)
POSTWAR PLANS	Determining policy for postwar activities	Majority of companies have plans—some very elaborate	Refine plans; translate them into realistic terms; keep pace with changing outlook. (p. 190)
PRODUCT DESIGN	Designing products for postwar production and sale	Many progressive companies have products ready for production	Co-ordinate design activity with market opportunities as they unfold
ENGINEERING DEVELOPMENT	Promoting technical progress	Impetus of war has accelerated progress tenfold. (See p. 254)	Round out uncompleted development work. Be ready to apply wartime "know how" to civilian production
INDUSTRIAL RESEARCH	Seeking new materials, processes, methods	Research laboratories are working at capacity	Extend and intensify research to limit
STANDARDIZATION, SIMPLIFICATION	Industry, national and international	Ambitious programs are in prospect	Co-operate on sound programs to help in war, later in peacetime production
LABOR RELATIONS	Promoting understanding between employe and employer	Unsatisfactory, due to one-sided government policy. (p. 193)	Utilize every opportunity to promote common interests of employers and employes
MEETING COMPETITION	Effecting income-expense relationship to insure profits	Efforts stymied by wartime conditions which discourage efficiency	Prepare carefully for resurgence of law of supply and demand as vital economic factor
DEVELOPMENT OF MARKETS	Promoting postwar market opportunities	Programs on ice, awaiting go-ahead signal	Get all possible data on extent and character of postwar demand
ORGANIZING SALES	Marshalling sales personnel for effective work	Plans matured, but action delayed by contingencies of war	Keep sales plans semi-fluid, awaiting clarification of future market picture
DISTRIBUTION	Re-establishing outlets for manufactures	Realignments on paper, action deferred	Be ready to key distribution set-up to conditions in transition and postwar periods
INDUSTRY-GOV'T RELATIONS	Co-operation with government agencies	Generally satisfactory	Keep pace with government rulings as wartime controls are modified, relaxed, withdrawn. (p. 191)
POLITICS	Participating in shaping of government policies	Industry's influence is disappointing; labor's in ascendancy. (p. 184)	Through sound counsel, continue efforts to win confidence of key men in public office
PUBLIC RELATIONS	Promoting understanding and good will of man in street	Industry stands well with public because of excellent war record	Expand existing good will by striving to attain foregoing objectives in 1945

Labor Extends Political P

EMERGENCE of organized labor as a major political factor was among 1944's most significant manifestations. Pressure exerted by labor had an important bearing on the shaping of national economic policies in 1944, and this pressure will be intensified in 1945. Labor now looms perhaps as the most powerful single influence in determining the kind of treatment which is to be accorded to business and industry in this country over the next few years. That the attitude of labor increasingly will influence the actions and policies of business, a fact that must be constantly kept in mind by business leaders from now on, is obvious.

The question thus arises: What will happen in our treatment of business and industry as a result of labor influence? The best answer appears to be as follows: On the basis of what labor already has brought to pass, the nature of the program it now advocates, and the prestige that labor enjoys in its dealings with the administration and with Congress, most Washington observers believe that government management of American economic policies will continue to veer in the general direction of "a little to the left of center"—at least for some time to come.

Best organized and most capably manned of the labor organizations is the Congress of Industrial Organizations; it knows exactly what it wants and how to go about the accomplishment of its desires. The CIO long has had the inside track at the White House and in important administrative circles. It is given much credit both by the administration and by members of Congress for the election results of 1944. The things that the CIO wants are representative; the difference between its program and those of other labor organizations, aside from the fact that the CIO program is the most comprehensive, are minor.

Finally, official Washington is thoroughly aware of the continuing objective of the CIO, through its Political Action Committee, and through the affiliated National Citizens' Political Action Committee, to qualify a huge additional number of voters in 1948.

This program is tremendously significant from the stand-

By E. C. KREUTZBERG
Editor, STEEL

Influence

Unions become most influential factor in determining national policies. Leaders have entry to White House and Capitol. Success of Political Action Committee indicates organization's influence will be retained and broadened

point of the nation's future, for the new voters would be recruited largely from among the lowest income groups. The two PACs propose to get poll taxes repealed and to remove other franchise barriers.

In the spring of 1944 the CIO was able to enroll some 100 congressmen in a consumers' committee to fight the proposal to place a sales tax in the 1944 internal revenue law. That was before the PAC started to make history, and at a time when nobody had any idea how the fall elections would go. When noses are counted in the 79th Congress, the bloc of votes amenable to CIO influence should be considerably larger.

Of the various organizations concerned with government policies and politics in Washington, the CIO is far and away the most active. Philip Murray, Sidney Hillman, Samuel Levin, R. J. Thomas, James B. Carey, Walter Reuther, Samuel Wolchok, Lee Pressman, George Addes, Emil Rieve, Richard T. Frankensteen—these are a few of the better-known figures in the CIO who have entry to the White House and who are well received by the numerous committees of Congress when they appear, as they do with great frequency, to push their ideas on legislation.

These officers of the CIO and of CIO unions also are surrounded by handpicked men who know their way around and who are addressed by their first names when they visit Capitol Hill.

The prestige enjoyed by the CIO is reflected in the caliber of speakers who appear at its conventions. When the CIO met in Chicago in November, Lieut. Gen. Brehon Somervell told the assemblage that "Hollywood has not adjectives stupendous enough to describe" the immense production job that has been done. The Most Rev. Bishop Bernard J. Shiel, D. D., Senior Auxiliary, arch-

Probably more than any other element in American society, organized labor has gained entry to the White House and the Capitol. Its representatives are assured attentive ears by the administration and by Congress. Success of the Political Action Committee in the November elections will enhance the already powerful position of labor leaders in Washington

diocese of Chicago, called for a "break" for the common man; he urged revision of the Little Steel wage formula and adoption of the guaranteed annual wage. Vice President Henry A. Wallace advocated a $2500 yearly minimum wage and "supremacy of human rights over property right." Mrs. Eleanor Roosevelt complimented the CIO on getting out the vote and urged continued education of the masses.

Among other guest speakers was Congresswoman-elect Emily Taft Douglas of Illinois who urged the CIO to "keep plugging for the 1946 election."

Here is a brief list of the more important accomplishments of the CIO on the national scene in 1944.

1. It successfully fought off an attempt to include a general sales tax in the Internal Revenue act of 1944.

2. It successfully fought off a strongly-backed attempt to enact a national service law.

3. It contributed powerfully to an extension of the Price Stabilization act, and it successfully fought off amendments that would have gone far in weakening the established price and rent control legislation.

4. It exerted the dominant influence in formulating labor utilization policies of the War Manpower Commission.

5. It won substantial pay increases for some 400,000 steelworkers.

6. It won out in its fight against relaxing provisions of the Contract Renegotiation act.

7. It won from President Roosevelt and from a number of congressional leaders the assurance that they would support the CIO demand for a guaranteed annual wage; it prevailed on the War Labor Board to set up a special commission to study all factors involved in the guaranteed annual wage issue.

8. It instigated the Pepper resolution in the Senate setting 65 cents an hour as the floor under wages.

9. It helped to draft the final wording of important new laws, notably the G. I. Bill of Rights and the Surplus Property Disposal act.

Despite this list of accomplishments, the CIO is far from satisfied. It failed to get its tax program adopted in full, particularly its demand for still higher taxes on corporate income, and a floor under salaries. It takes particularly to heart its failure to get Congress to pass the original Murray-Kilgore-Truman bill which would have taken care of the "human" side of reconversion. The George bill which was passed provides for a 12-man board, representing industry, labor, agriculture and the general public, to advise the Director of War Mobilization and Reconversion; the CIO-backed Murray-Kilgore-Truman

Industry's Changing W

Reconversion Problem

WHILE 1945 will likely mark the turn in the recent succession of record steel production years, prospective war demands are far more lively than anticipated in recent months, due to prolongation of the war in Europe and revised estimates of overall munition requirements.

Present war production of $5,700,000,000 monthly is expected to continue at that rate until V-E Day, according to J. A. Krug, chairman, War Production Board. This compares with about $5,500,000,000 a year ago and with around $5,282,000,000 last July, the lowest point in 1944. Overall war expenditures are running at the rate of $8 billion monthly, or $96 billion annually.

Incidentally, the government is now financing about 40 per cent of expenditures through taxation. Earlier in the emergency the percentage was somewhat lower, and it is estimated that when the final average can be figured it will be found that about 35 per cent of the cost of running the war was financed through current revenues. The public debt of around $213 billion will likely be well more than $300 billion when the war is over, with interest charges alone amounting to about $6 billion.

Current surge in military demands should go far toward sustaining production until V-E Day, and instead of a curtailment in war work of 40 to 50 per cent on that day, as indicated last fall, Washington is predicting a decline of no more than 15 to 25 per cent, with V-E Day indefinitely in the future.

War Production

The overall war production job has been excellent, military officials assert. There have been no actual short-

bill would have vested this board with an important planning function, and with direct access to both the President and the Congress. The CIO still is studying all the possibilities of the bill that was passed and is expected at an early date to recommend new legislation. The CIO also proposes to renew its fight, in 1945, for quite a few other objectives. A partial list is as follows:

1. Further extension of price controls and rent controls.

2. Following completion of war work, payment of the same amount of take-home pay for 40 hours (provided 40 hours is set as the length of the standard work-week) as has been received throughout the war for a longer work week; unification and federalization of unemployment compensation; protection of wage rates; adoption of the principle of the guaranteed annual wage; government benefits to compensate war workers for expenses incurred in getting settled in peacetime jobs.

3. Immediate revision of the Little Steel formula to permit wage increases geared to the actual increase in the cost of living; a shakeup and expansion of the Bureau of Labor Statistics to fill an alleged need for reliable labor research and reliable cost-of-living statistics.

4. Repeal of the Smith-Connally Law, on the ground this law has "served to encourage strikes and retard production;" repeal of the Hatch act which denies federal employes the right to engage in political activities.

5. Intelligent collaboration with other nations, and labor unions of other nations, in the interest of good international relations, and to promote employment in the United States on the basis of expanded foreign trade.

6. Reconstitution of the President's Fair Employment Practices Committee as a permanent statutory agency financed by direct congressional appropriation; complete elimination of racial bias and discrimination.

7. Enactment of the Wagner-Murray-Dingell social security bill calling for government medical and hospitalization service, maternity benefits, permanent disability payments, federal grants for more liberal state and local assistance, and other expansions beyond the present social security system.

8. Federal participation in housing programs, to provide decent low-cost housing for workers; elimination of slums.

9. Enactment of a "reconversion period" tax measure with these provisions: Continuation of present tax rates on corporations having net incomes of $100,000 or more and on persons having incomes above $5000; favorable tax treatment for corporations with net incomes of less than $100,000 to "assist small business"; reduction of the tax load on persons in the lower income groups; increase in exemptions to $2000 per married couple and $500 for each dependent child; repeal of the present 3 per cent normal tax, which "victimizes" the lower income groups; extension of the carry-back and carry-forward principle to individual taxpayers; taxation of present tax-exempt securities; closing of estate and gift tax loopholes; complete avoidance of any form of sales tax which would be a direct raid on the purchasing power.

(*Please turn to Page* 406)

War Task Complicates

By B. K. PRICE
Associate Editor, STEEL

ages abroad of shells and guns and other such essential equipment, but reserves have been reduced and must be built up in order to maintain the offensive at highest tempo.

Renewed pressure on steel for the heavy shell program is indicated by plans to step up output from around $45 million monthly to $80 million by March and $100 million later in the year. Last spring production was under $30 million monthly. Increase in requirements for mortars and mortar ammunition is reflected in plans for expenditure of $500 million for new plant facilities.

Renewed demand for military goods will serve to alter the outlook in the steel market over coming weeks. Shells and guns will exert greater pressure on steel bars, with

Highly-polished cartridge cases receive final inspection at the Washington Navy Yard. Official U. S. Navy photo from NEA

Disposal of surplus property was started last year on a limited scale. Pictured here is an auction sale of surplus construction implements. NEA photo

hot top ingot capacity forced to the limit. Rockets will cut sharply into cold drawn bars, especially in the larger rounds 2¼ to more than five inches. Bars will likewise be affected by the heavy truck programs, ships, etc.

Tubular schedules will further reflect the impact of the shell program, and shape schedules should remain fairly tight as the indirect result of shell work and ship tonnage backlog. Indications, in fact, point to continued stringent limitations on building construction.

Pressure for sheets is likely to continue, and despite further shifting of strip mills to sheets no early easing of delivery promises appears likely, due in part to shortage of manpower.

Radar and other communications equipment will make substantial demands on wire, silicon sheets and a range of specialties. Hot alloy steels, lagging for some months, are expected to be more active before the current quarter is over. Tin plate will expand seasonally, reaching a peak in the second quarter; as will also rails, subject mainly to limitations of the shell program.

On the other hand, the decline in plate specifications should become more pronounced. Most sheared mills have sufficient tonnage on books to assure good rollings in first quarter, and their position may be further strengthened by the increasing diversion of plate tonnage in the strip mills. However, Maritime Commission specifications, which have been outstanding since the emergency began, are scheduled to decline sharply and there is little in sight to offset it in substantial degree.

In analyzing why certain war programs are listed as critical, Washington asserts that roughly 40 per cent of the cause is due actually to the step-up in requirements, 26 per cent to design change, 22 per cent to labor and 12 per cent to facilities. Also there is greatly increased need for repair parts.

Increases in some of these programs are projected well through 1945. But just what the situation will be, say, three months from now is difficult to foretell.

Military leaders say the war with Germany may run into next summer, and, conceivably, beyond that. With the time element entering into it so much, some trade interests believe that present estimates as to lessening in war work might run heavier than now indicated.

They point out, too, that with the fall of Germany, this country will then be fighting only one war instead of two, and suggest that even though the curtailments on V-E Day are no greater than now predicted, it might be only a short time thereafter before further sweeping cuts in the program will be made. Lieut. Gen. Brehon B. Somervell, however, recently spiked this latter idea by emphasizing the greater amount of materiel required in conducting war against Japan and predicted it would cost the United States $71 billion a year to fight Japan after Germany is defeated. Currently the global war is costing around $96 billion annually.

Contract Termination

SETTLEMENT of termination contracts, which became big business in 1944, will assume vastly greater proportions this year and particularly at the end of the war.

Total terminations by the Army, Navy, Maritime Commission and the Treasury Department from Pearl Harbor through Oct. 31 came to some $23 billion. This total included some $6 billion worth of cost-plus-a-fixed-fee contracts; of these contracts only $1 billion have been settled and the remaining $5 billion still are pend-

ing. The total included some $17 billion worth of fixed-price contracts, of which $9 billion have been settled and $8 billion still are pending. Many of these unsettled contracts have been pending since 1943.

This is an unfortunate situation, procurement officials say. Fast settlement is necessary for two reasons: first, to assist war production; second, the postwar reconversion period always looms ahead. As procurement officers see it, the contractor who does not co-operate in making it possible to reach prompt settlements is storing up trouble for the reconversion period ahead, for the country, and for himself.

Despite all that has been said on the subject, procurement officers point out, not all prime contractors as yet have gotten themselves organized for termination settlements.

Not only are prime contractors slow about seeking settlements on their own account, but many of them are lax as to their responsibility in preparing their subcontractors for termination.

There is no valid reason, so far as known, for the current widespread delay on the part of terminated contractors in seeking settlements, for thousands of men have been trained in termination procedure and are to be found in the district offices of the war agencies all over the country.

Furthermore, the process of settling terminated contracts has been smoothed out and improved. All representatives of the war agencies are armed with copies of the new Army-Navy Joint Termination Regulation known as "JTR." This 286-page volume replaces the former PR-15 of the War Department and the termination directives of the Navy. It contains all forms to be used in making out settlement proposals, a joint accounting manual, a uniform costing manual and other instructions. Compiled on the basis of a large amount of actual experience, it is intended to supply between two covers all information needed in effecting settlements.

To insure fast, fair and final settlements and to protect contractors against arbitrary action by individual officers, the "JTR" has a provision for setting up "termination teams." These in most cases will include the officer who originally contracted for the work, also a number of experts such as a trained negotiator, lawyer, an accountant, a property disposal officer and others specially trained in the various phases of contract termination and settlement work.

War Surpluses

PLANS for disposal of the huge government war surplus ($116 billion or so), have got off to an inauspicious start. Signed by the President Oct. 3 with "considerable reluctance" and described by the retiring Surplus War Property Administrator William L. Clayton as "unworkable," the Surplus Property Disposal Act of 1944 appears to have too many conflicting objectives and too poor an administrative setup.

While the existing War Surplus Property Administration has continued to function until a new Surplus Property Board of three has been officially appointed, the effect of the law has been to slow down the disposal process. Meanwhile it is pointed out it will require at least three months for the new board to learn its job. Further delay is regarded as almost inevitable.

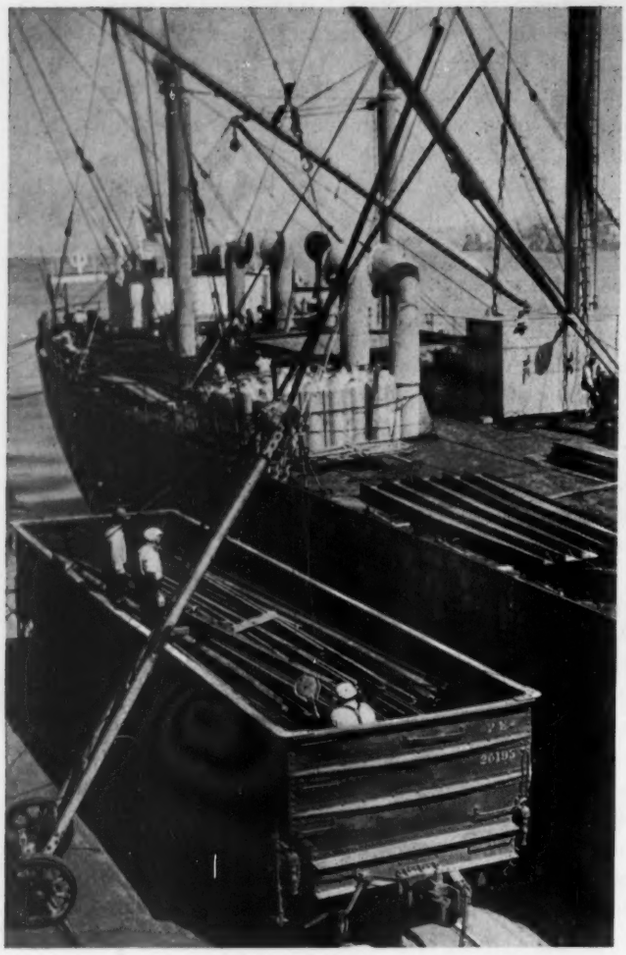
Undoubtedly the law will come in for considerable clarification. Some observers are convinced that it should be rewritten. Actually much of the $116 billion in surplus will not become surplus until after Japan is defeated and, hence, liquidation of a considerable portion will not become desirable for some time. However, collapse of Germany should see the offering of substantial surplus, with relatively limited but still sizable amounts of excess goods and property being offered meanwhile.

According to present estimates, the government will own industrial plants costing, with their equipment, more than $15.5 billion and having total floor area of approximately 10,000 acres, when the war ends. Besides these facilities, there will be various combinations of government and privately owned plants and equipment.

A major problem along with the effective disposal of equipment, is removal of equipment as promptly as possible so as not to retard reconversion of plants. To expedite removal and necessary storage of much of this equipment government agencies, it is estimated, will need approximately 100,000,000 square feet of storage space.

Of the various classes of federally-financed plants and facilities likely to become surplus after the war the largest covers airplane, engines, parts and accessories manufac-

A number of small plants began partial reconversion to peacetime goods when their war contracts were terminated. Here a worker in the Monterey Park Products Co., Monterey, Calif., casts juice pressers. Company also makes mounts for machine guns. NEA photo



Normal export trade has been disrupted by the necessities of war. An accumulated demand awaits the coming of peace. NEA photo

turing facilities with a total value of $3,012,000,000. Others include ship construction and repair facilities, $2,181,000,000; explosives and ammunition loading, $2,492,000,000; guns and ammunition $1,867,000,000; iron and steel facilities, $1,308,000,000; and nonferrous metals, basic and semifinished $1,114,000,000.

Government-financed iron and steelmaking and affiliated facilities are located in 25 states, with the largest investment in any one state, $311,000,000, in Pennsylvania, according to government advices. Approximately $216,000,000 were invested in Utah, and $137,000,000 in Illinois. For nonferrous metal facilities, $134,000,000 were invested in Michigan and a similar amount in Nevada; and $111,000,000, in Washington.

Surplus steel on hand V-E Day may amount to 15,000,000 or 20,000,000 tons in the opinion of some trade observers. With revision in government estimates as to cutbacks and cancellations when Germany is defeated and the measures taken to reduce inventories late last summer and early fall, when a European armistice was believed not far off, surplus stocks should be substantially lighter than estimated five or six months ago.

Indicating the huge disposal problem involved in connection with heavy equipment alone, the government owned as of Oct. 1 between 500,000 and 600,000 machine tools, a large proportion of which will eventually be declared surplus. At the beginning of the war in Europe, interestingly, there were 900,000 machines in the entire United States.

Postwar Plans

ALTHOUGH industry's war production job at this juncture appears a long way from completion, planning for the postwar period is not being overlooked. The future economic stability of the nation will depend in large measure on how sound a postwar planning job is done now before the war ends. That the economic transition from war to peace will not be easy is recognized by all competent observers. Jobs for 60 million workers will have to be provided as compared with 46 million in 1940, and this means industrial production will have to be expanded far and beyond anything achieved in any previous peacetime year.

In the iron and steel industry resumption of normal peacetime activity will be greatly influenced by underlying economic trends. Both highly inflationary and deflationary forces will have to be contended with. On the one side, it is pointed out, there will be vast shortages of goods and services which will have been accumulating since prior to the war; there will be a backlog of $100 billion to $125 billion in buyers' hands, according to present estimates, and potentially a large foreign demand.

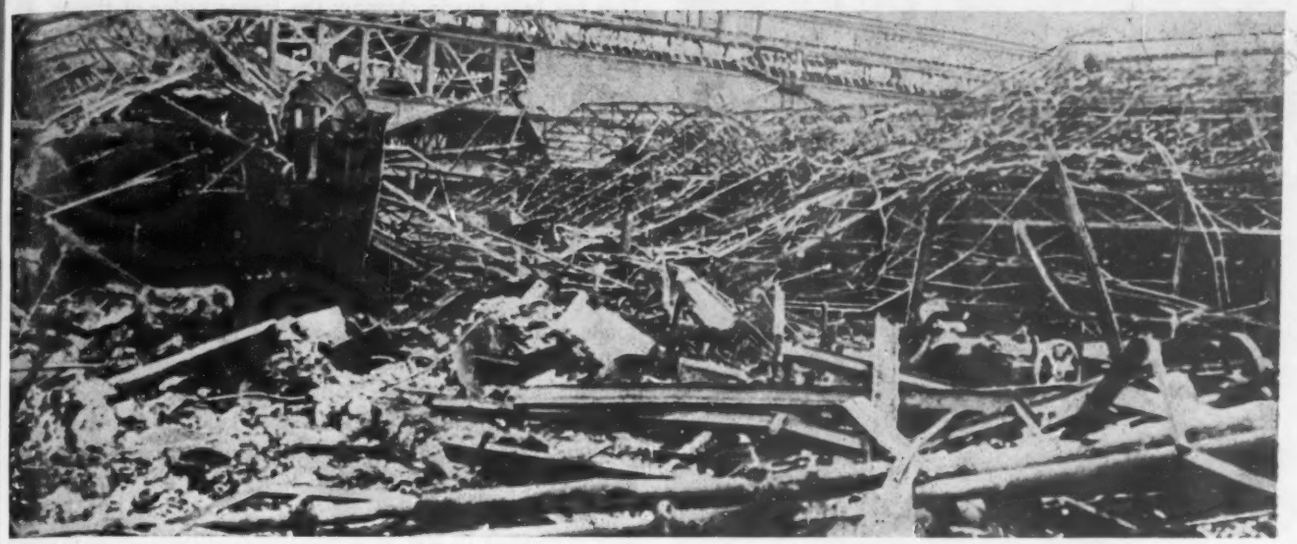
On the other side, there will be the tapering of huge government expenditures, even though they may still continue high; considerable oversupply of various basic raw materials; adding of demobilized war veterans to the labor force and general uncertainty about future employment, which may deter many people from drawing on their savings. Upward trend in labor costs, which if allowed to continue, might serve as a deterrent to investment; also unstable tax policies. Likewise, failure to release many wartime controls on business as promptly as possible would also prove to be a depressing factor.

If the emphasis is to be on high wages and short hours, instead of production, a policy which many believe extended the prewar depression for several years (with only the war, in fact, to definitely break it up) troublesome days may lie ahead, if not after V-E Day, certainly after Japan is defeated, it is pointed out.

Industrialists stress the importance of first making it possible for business and industry to have the confidence to go ahead and expand their enterprises and establish new ones and thus provide for the increase in jobs which is so desirable after the war is over. The pegging of wages and salaries at high levels, without the production to back it up, on the assumption that sufficient buying power will thus be engendered to do the trick is regarded as fallacious.

To the extent that taxes can be set up on a firm and equitable basis and not be subjected to constant change in laws and interpretation to the point where management, as in recent years, finds it impossible to plan ahead, and to the extent that capital, as well as labor, can be assured of reasonable compensation, can jobs, and in turn prosperity, be soundly expanded, it is contended.

Hopeful that sound enterprise-stimulating policies will be in the ascendancy by the time the country does get



Reconstruction of devastated countries is expected to create a healthy export market for steel. Pictured is the Renault plant at Paris after being hit by Allied bombs. NEA photo

down to "hard cases" in the shift to peacetime production and is confronted with the task of finding work for literally millions of returning war veterans, as well as large numbers of employes now engaged in war work, various large companies in position to do so are planning postwar programs involving the expenditure of millions of dollars.

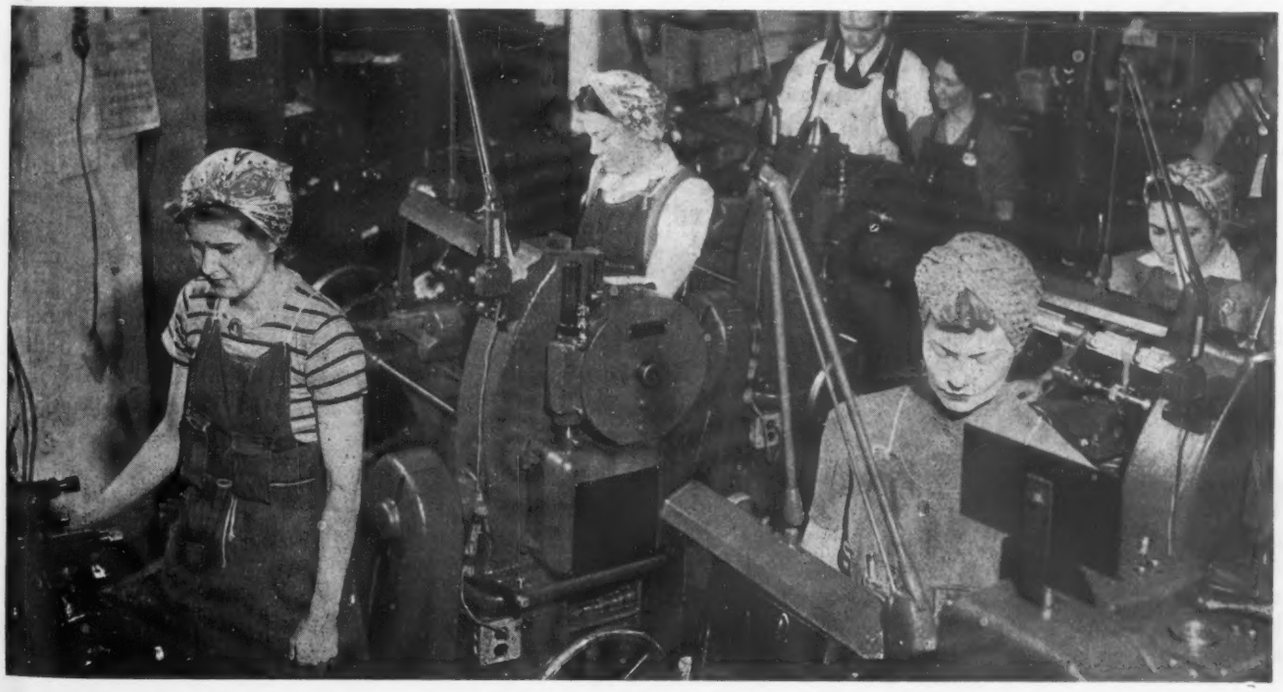
Reconversion

DESPITE accelerated demand for military goods and resulting deferment of industry reconversion from war to peacetime production, transition planning is going ahead with indications many lines of industry will be in shape to resume normal production, at least on a partial scale, after V-E Day.

As a matter of fact the reconversion job in most industries will not be as troublesome as many observers had thought it would be some months ago. Thinking has been clarified on the subject after months of study and discussion, and it is now widely held that so far as the actual physical effects of reconversion are concerned the problem has been greatly exaggerated. On this point Brigadier General Albert J. Browning, assistant director of material, Army Air Forces, recently claimed less than 20 per cent of industry ever converted plants in the first place, and added that in the metalworking industry some lines have already been largely converted back to their peacetime operations.

Encouraging in this respect too, is a recent check of leading companies by the National Association of Purchasing Agents, which indicated better than 75 per cent

Women flocked to war plants to help solve the manpower problem created by the induction of millions of men into the armed services. Here they are shown tending gear cutting machines in an arsenal. NEA photo



Discharged veteran demonstrates how he has adapted himself in using an artificial arm. NEA photo

of the companies with which the purchasing agents do business will have no reconversion problem. A substantial percentage of those remaining will have only partial conversion to contend with, the change-over periods varying, according to their own estimates, from four to 20 weeks.

However, there are important industries whose reconversion problems appear far from simple. Notable in this category is the automobile field, which is still making trucks, but which will have to reconvert the passenger car end of its business completely.

The present legislative framework for reconversion was set up last fall in the enactment of the War Mobilization and Reconversion Act of 1944 and the Surplus Property Act of 1944.

While the War Production Board has plans well along for relaxation of controls after V-E Day, officials say they cannot be discussed until there is a better indication as to when the European phase of war will end and what military procurement needs for the war against Japan will be.

Today it appears that all the 350 orders which WPB had hoped to drop after V-E Day will probably not be dropped until after V-J Day; that when Germany is defeated there will be relatively only a few relaxed, with the dropping of others proceeding at a cautious rate over a number of months.

Civilian Goods

RESUMPTION of civilian goods production on a broad scale has been deferred indefinitely by developments in the war. When government controls will be greatly relaxed depends entirely on the turn of events in Europe. This has been made clear by the freeze order of the War Production Board holding civilian goods production in the first quarter of 1945 at the level of the last quarter of 1944.

Despite the shortage of some goods civilian buying last year was record-breaking. The Department of Commerce estimates that $97 billion were spent for such goods and services during the year, 6 per cent more than in 1943 and more than half again more than in 1939, when spending totaled $61,700,000,000. Some of the increase was attributable to higher prices but the actual quantity of goods and services bought also was larger than in the preceding year. At the same time while there were some inconveniences, there were no actual hardships.

Last summer while Congress was laboring over reconversion legislation, the production and military services were in a spirited controversy as to need for taking certain immediate steps as proposed by Donald M. Nelson, then chairman of the War Production Board, toward reconversions. Following a demand from James F. Byrnes, director of War Mobilization, for the opposing factions to get together, the Nelson program of four points was finally accepted, including spot authorization.

During the first three months the spot authorization program was in operation about 2000 applicants were granted permission to either resume or increase output of civilian products. More than 70 per cent were small companies, employing 50 persons or less. Rejections amounted to about 500, mostly at the instance of manpower authorities, and formal action was held up on perhaps three times that number.

Total value of these authorizations was said to have run around $300,000,000 spread over the remainder of last year and all of 1945.

It was predicted by leaders in industry last summer an early defeat of Germany would temporarily mean a drop of 30 to 40 per cent in steel demand. With Washington now predicting much lesser curtailment in the war program than indicated at that time, the drop in steel requirements logically should be less when V-E Day comes.

Reconstruction

EXPORT requirements are shaping up more encouragingly as a steel outlet after victory. While policies and technicalities to be pursued later in foreign trade are as unsettled as ever, important preliminary discussions have been held recently at such places as Bretton Woods, Dumbarton Oaks, Rye, and New York. With such subjects as foreign exchange, shipping, international credits, lend-lease, international debits, cartels, subsidies and trade barriers of all kinds, discussions centered on a formidable array of problems, but at least a start toward clarification has been made.

It is now the expectation that when V-E Day arrives several of the devastated countries will be further along on their rehabilitation planning than was reasonable to anticipate only a short while ago. France and her colonies already have large orders placed and pending, although not so much for steel, as for products made of steel, and orders are beginning to accumulate from Holland and

Belgium and other areas now freed from actual conflict. Russia's requirements continue to mount and various neutral countries have orders on file here pending release as soon as military requirements ease appreciably in this country.

Some export authorities believe that after the war is over this country for a while will have the export field practically to itself.

Lend-lease will be cut off quickly once hostilities are over, exporters believe, and a start in this direction is already to be noted in sharp curtailments in the movement of lend-lease material to England.

Manpower

WHILE manpower was not the No. 1 problem throughout 1944, there were times when it was close to it, and at all times it was a source of worry and trouble to management. That it is going to continue troublesome for some months to come is generally accepted.

During the early part of last year there was the particular complication of building up the armed services for the Normandy invasion. There was no question but what the armed forces would get the manpower needed, but industry was greatly relieved in the spring when the army decided to draft only those under 26 years of age.

Later, with the Normandy invasion going well and with substantial cutbacks beginning to appear in some lines, there began a pronounced shift of workers away from war industries, and thus a new source of worry was created.

Cutbacks accounted by far for the greatest exodus, but the mere fact that these cutbacks were beginning to appear and that the war was going well, caused workers, in increasing numbers to start seeking jobs with a postwar future.

Recently the manpower problem of the moment appeared to involve the need for 300,000 able-bodied men. This number it was said would break the bottleneck in supply of such urgently needed munitions as heavy shells and guns, heavy bombers, heavy trucks and so forth. There are indications now that under measures being exercised the situation may right itself to a considerable degree within the next few months.

Interestingly, since the peak in the output and employment in the munitions industries was reached in November, 1943, there has been a drop in production up to and including September of last year of about 5 per cent, or from an annual rate of $66.7 billion to $63.6 billion, and in employment a drop of 10 per cent, from 10,400,000 to 9,300,000.

War Veterans

REHABILITATION and re-employment of war veterans rank among the major tasks of the nation as it enters the fourth year of war. Already thousands of men have been discharged from military service for medical and other reasons; many of them have re-entered industry. And the problem will become increasingly difficult from month to month as more men return, culminating in a tremendous problem when the war is ended and millions will be demobilized.

Industry as a whole has been meeting promptly and intelligently its moral obligation and legal responsibilities toward its returning servicemen.

Much of the effort that has been expended, and must be expended in the future, revolves around the problem of definitely determining the physical and mental abilities of the veterans to perform civilian duties, learning what type of work they desire to do, and then training and supervising them until they are working efficiently.

As long as the producing facilities of the country are engaged in turning out the present huge volume of materiel, industry will encounter little difficulty in absorbing servicemen as fast as they are released. Returning veterans are taking justifiable advantage of this "selective" employment market. A very large percentage of the veterans who have been discharged have not returned to their old jobs. They have chosen new fields of endeavor in which they may capitalize on new skills and training which they acquired in service, or have entered war plants which have an urgent need for workers.

Labor Relations

MORE strikes occurred during 1944 than in former years and more workers were involved, but there were fewer man-days lost, indicating quicker adjustment of disputes.

During the first nine months, with figures for the last two of these still not final, there were 4350 strikes, involving 1,640,000 employes and accounting for a loss of 7,130,000 man-days. At this rate for the entire year (although it is very possible that the last quarter will show less disturbance) the number of strikes would be 5800, employes involved 2,188,000, and man-days lost 9,532,000. This would compare with 3752, 1,981,000 and 13,501,000, respectively in 1943, the worst year in point of man-days lost since the beginning of the emergency.

While figures for years before 1943 are not fully comparable, as they refer to strikes involving wage-earners only, it is interesting to note that in 1937, the worst prewar year, 28 million man-days were lost. This resulted from 4740 strikes, involving 1,861,000 workers, thus indicating that stoppages in that year were longer and more concentrated.

The war has resulted in a reduction in time lost due to strikes. But the fact that there has been anywhere near the number of strikes and man-days reported lost in the last two years in particular, is a sad commentary on the government's wartime labor policy, and especially as such strike figures do not tell the whole story of slowdowns, absenteeism and many spot strikes that never get into print. Last May, just before the Normandy invasion, the strikes that actually were reported were the greatest in number since May, 1916, and all this despite the wartime no-strike pledge of labor leaders, who apparently were helpless in many cases to do anything about it.

Steel Industry Faces

Scrapping of uneconomical open-hearth furnaces expected after war. Intensive sales effort needed to keep electric furnace capacity occupied. Study being given methods of beneficiating low-grade ores. Part of cost of many new basic metal plants probably can be charged off to cost of making war

IF V-E Day were to come tomorrow and V-J Day close on its heels, what would happen to the steel industry's capacity for the production of 67,391,270 tons of pig iron, 82,604,600 tons of open-hearth steel, 6,074,000 tons of bessemer steel and 5,372,150 tons of electric furnace steel?

Will there be sufficient demand to absorb capacity for producing 2,305,000,000 pounds of aluminum and 586,000,000 pounds of magnesium? What about the added capacity for producing copper alloys for cartridge cases? The new plants for making high-grade zinc, ferroalloys and the like?

The changeover from war to peace will find no quick answer for these questions but it seems apparent that a share of the money spent for new plants for making basic metals can be charged off to the cost of waging war, like so much expendable ammunition.

Part of the new facilities surely will be continued in use as replacements for older plants. Part will be needed to care for an overall anticipated increase in demand for all types of commodities. But, a considerable portion will not be needed as indicated by the present situation although the war still is in one of its most serious stages. The steel industry's expansion program already has been cut back, even including one brand-new blast furnace being held as standby equipment. Similar cutbacks have been made in the nonferrous metals, especially the two light metals, aluminum and magnesium.

What will happen to the Geneva (Utah) Steel plant, part of which is shown here with 12,008-foot Mt. Timpanogos as a backdrop, after victory is won? Westerners hope the $180 million mill, built with federal funds to supply iron and steel for shipbuilding and other war industries on the West Coast, will continue to operate after the war

Face Depletion of High-Grade Ores

Many pig iron producers are not as much concerned over excess capacity as they are over the raw material situation. They are faced with a growing depletion of high-iron content Mesabi ores obtained by open-pit methods of mining. Some believe that by 1954 present open-pit reserves will be exhausted; others believe this is improbable and place the danger point many years hence. Nevertheless a committee of representative steel companies now is giving serious consideration to the problem of beneficiating the less desirable ores of the Great Lakes district.

No immediate danger of shortage of high-grade ore even at a production rate of 100 million gross tons annually is apparent, according to H. E. Hansen of the National Industrial Conference Board, New York. Cessation of wartime demand and a return to a normal production of around 50 million tons of iron a year would add to the life of present ore reserves. A large taconite (30 per cent iron) concentration industry has been recommended for overcoming the future ore shortage but the main objection is the high cost of beneficiation in comparison to present ore prices.

However, some believe that with proper planning in advance sufficient ore can be produced to satisfy the needs likely to arise in the future. It is pointed out that costs are expected to be higher than today and that the financial problem which would confront individual companies under these conditions would vary. Capital investment per ton of ore needed per year would be far greater than today. Some believe the industry will cope with the problems as they arise and cite the steps already taken by steel companies in opening up ore properties in New York and New Jersey.

Some of the iron and steel companies in the Birmingham district are having to go farther afield for their ore supplies and even to the small pockets and hence serious consideration is being given to beneficiation as a means of utilizing low-grade ores. For several years self-fluxing ore has been obtained from Red Mountain near Birmingham but at present shale partings from 12 to 18 inches are encountered. This raises some problems but none is serious inasmuch as heavy media tests disclose that ores with rock can be greatly improved by a heavy density solution method. There is talk of a plant being built using this method in the Birmingham area.

Even considering the possible exhaustion of Red Mountain self-fluxing ore it is felt that Southern blast furnace practice can be extended 50 to 75 years, based on present-day operation, by utilizing the silicious ores found in the district. These contain from 30 to 34 per cent iron (equivalent to northern ores of 45 per cent iron because

Adjustment Problems

By J. D. KNOX
Steel Plant Editor, STEEL

of the lime content) but by concentration the iron content can be increased to 45 or 47 per cent, and further increased to around 50 per cent by sintering. At present the DPC plant at the Spaulding mine is turning out from 1600 to 1800 tons of concentrate daily with marked success. The furnace travels faster with concentrate on the burden, throws more iron, and operates with a smaller slag volume and a lower coke consumption per ton of iron.

Ash Content Is High

The ash content of the coals in the district is now as high as 9 per cent and some companies are mining 2 tons to obtain 1 ton. In fact, coal secured from one mine before washing has 19 per cent ash and after washing 8½ per cent. One of the most serious problems with which southern operators are faced is the increasing amount of "middle man" or rock being taken out with the coal at practically every southern mine.

Termination of the war in Europe perhaps will not leave such a deep scar on the blast furnace industry as was apparent following World War I. Perhaps a half dozen or so isolated stacks will go out of blast never to resume because of high operating cost. Already there has been some dismantling of stacks owned by integrated operators and more undoubtedly will follow since they cannot be operated economically. Some of the Defense Plant Corp. stacks built under wartime measures already have been purchased by one steel company. It appears likely that other companies will start negotiations after cessation of hostilities for the purchase of blast furnace and steelmaking equipment built on or adjacent to their property. Other alternatives, of course, are for the government to give the steelworks a coat of red oxide paint to combat the elements or dismantle them.

Open hearth capacity also will undergo revision for here again the construction of wartime shops has made many furnaces as obsolete as the proverbial Toonerville trolley. In some new type plants a single furnace will produce more than three units of the prewar type.

Based on the interest now shown in basic brick linings it would appear that more shops will revert to this type practice. At present four open hearths have partial basic linings and shortly a complete basic furnace will be placed in operation. Those who have been experimenting with basic linings state that less time is required for rebuilds, the ends give longer life, accumulations in the slag pockets are removed easily, and the amount of dust deposited in the checkers and flues has been reduced about 50 per cent. One steelmaker cautions that it takes 600 heats to break even on the cost of installing basic brick but he also cites campaigns of furnaces with basic ends exceeding this number of heats.

When the steel industry returns to normal again it will find from 15,000,000 to 20,000,000 tons of excess ingot ca-

pacity casting its shadow over prewar output. Some steelmakers believe the uneconomical units should be scrapped. Others are of the opinion that the excess capacity should be used to satisfy postwar demand which is expected to materialize from foreign buyers. Still others hold that a fence should be thrown around these emergency plants and that they should be kept intact as standby units pending any international trouble that might develop in the future.

Electric steel industry is at the crossroads, according to the statement of one producer. About 7,000,000 tons of capacity is available but this never has been at top production. How will it be used when the last gun stops firing? Belief is expressed that electric furnace capacity is greatly overbuilt and that if some of the plants are to continue in operation they may have to be subsidized to the extent of at least $10 a ton if they are to compete with new, larger plants built for wartime production. Others advance the opinion that alloy steels will become more standardized and hence not so many types will be made in electric furnaces.

On the other hand the economy of 80-ton electric furnaces is greater than that of smaller furnaces such as 10 and 15-ton units. The larger units have only been operated on armament steels—never on any big tonnage of the usual run of electric steels that sales departments could offer the trade. Experiments, therefore, are being made to determine the advantage of the large units in making low-sulphur and residual steels for high-silicon sheets, deep drawing stock, etc. and from the information gained so far it will be up to the sales department after the war to move tonnage made by this branch of the industry.

Will Watch Procedure More Closely

Heretofore there has been little concerted effort in the electric furnace shop to model the procedure after that followed in the open hearth. To illustrate, the ingot discard usually is heavier and if the electric furnace crew decided to take an extra hour or so to shape up the heat for tapping, no one objected. But in the postwar era when power rates may ease off if power companies want more business, and when cheaper scrap is available there may be an incentive to squint at operating procedure a little closer.

Then, too, there is the question concerning the supply of suitable scrap for electric furnace operation. Some steelmakers believe that because of the difficulty in obtaining suitable tonnages of scrap, the use of sponge iron in the charge may be the answer. Consequently word is awaited by the industry concerning the test operations of Republic's new plant at Warren, O., which is converting concentrates from its New York state mines to sponge iron and shipping the product to its electric furnace shop at Canton, O. Meanwhile, one eastern electric furnace producer has made several heats with sponge iron secured from a source in South Carolina and is of the opinion that heats made from this material are superior to those produced from all-scrap charges. Its low content of iron oxide produces only a light boil, and it is freer from detrimental gases and nonmetallics in solution with iron than any other base material with the exception of high-grade muck bar.

After the war is over some electric furnace steelmakers expect a scramble to increase the pressure on inspection of the finished product as well as a decrease in the tolerances. The future of alloy steel is tied up with the ability of the industry to meet specifications, applications, hardenability, etc. and opinion leans toward big electric furnaces as one of the few means of satisfying requirements.

Extensive investigation for controlling the factors affecting the work-hardening characteristics of bessemer steel are underway, the results of which will be of considerable value to the wire industry. Many items, which now require a sulphurized open-hearth steel for balanced free machining and cold forming properties, may be produced more satisfactorily in the days just ahead from a scientifically controlled bessemer steel application.

Sheet Mills To Reconvert

Three things stand out in the rolling mill field that likely will command attention when the white flag goes up, namely the reconversion of continuous plate mills back to strip mills, the potential market for the new unitemper mill for rolling black plate, autobody sheets, strip, etc. and the potential market for the "invasion pipe" mill. Plate mill conversion is not a serious undertaking. It should not take much time to remove the extra shear line and the jerry-built handling equipment and oil up the coilers. In fact, some of the installations may be scheduled on strip before the termination of the war.

The unitemper mill, which is being closely watched by tin plate makers, processes the strip continuously by a stretching operation and to the extent necessary to obtain the desired temper, hardness and ductility in the strip while the mill operates between 2500 and 3000 feet per minute. The first mill of this type now is in commercial operation at the Niles, O., plant of Republic Steel Corp. where it was tested and perfected in co-operation with the rolling mill builder. Details of the mill were presented in the Dec. 11, 1944 issue of STEEL.

The electric welded pipe mill is built with 11 stands of tube forming rolls of the conventional type, a 750-kilovolt ampere welder, a sizing and straightening mill, and subsidiary equipment and has been viewed in operation by representative groups of officials and technical men from the steel and tubes industries. The mill has been in operation for many months on 6-inch invasion pipe used to snake its way from tankers to front lines in combat zones. The purpose of the pipe is to do away with the delivery of water, oil and gasoline to the front lines by motor transportation. Lines laid up with this pipe have been able to keep pace with the rapid advance of our armies over any sort of terrain. A grooved collar is attached to each end before it leaves the States; on the battlefield a simple clamp links the pipe easily and speedily. There is some talk that a few of these mills will be stored after the war against future contingencies.

Prospects of the West's iron and steel industry still is a matter of wide discussion. It has been suggested that the government expend another $40,000,000 on the Geneva Steel Co. plant at Geneva, Utah, in order to make available a wider range of products. Hot-rolled strip is one of the items mentioned. It could be shipped from the plant to any part of the Pacific Coast and also be converted on 4-high mills into tin plate for the western canning industry. In case the government decides to dispose of the Geneva installation, it further has been sug-

gested that the plant be sold to a postwar private operator at a nominal price, with the remainder of its cost written off as a wartime expense; or that the disposal price be based fairly on that portion of its capacity which might be used efficiently for peacetime production, with the price adjusted on a sliding scale so that it could be advanced if the plant is operated at higher rate of capacity than originally agreed on.

Others believe that if the West's iron and steel industry is to thrive under postwar conditions four factors must be considered: (1) Freight rates from the Mountain states to the Pacific Coast must be reduced and the rates from the East to the West adjusted; (2) an opportunity must be extended to private industry to absorb government-owned war plants on long-term contracts; (3) taxation must be adjusted to provide an incentive to develop new industries; and (4) the rapid reconversion of fabrication plants to avoid widespread unemployment.

The iron and steel industry in the Southwest presents every promise of being a factor in postwar. Most plants are on tidewater and assembly costs are not out of line with other areas. At present the stack at Houston, Tex., is being operated on washed Texas ore from the South basin. Later, it is planned to use 75 per cent Texas ore and 25 per cent from Mexico. Texas ores mined in the North basin contain 29 per cent iron and 13 per cent silica; those in the South basin analyze 45 per cent iron and 11 per cent silica.

Expanded To Meet War Demands

Originally the Houston plant was laid out with a rod-bar mill, a jobbing mill and wire mill to roll jobbing plates, rods and small structural and wire-drawing equipment. Later under war demand a blast furnace, five open hearths, a 35-inch bloomer and a 112-inch plate mill were built. By a few simple changes in the layout, the plate mill could be converted into a strip mill.

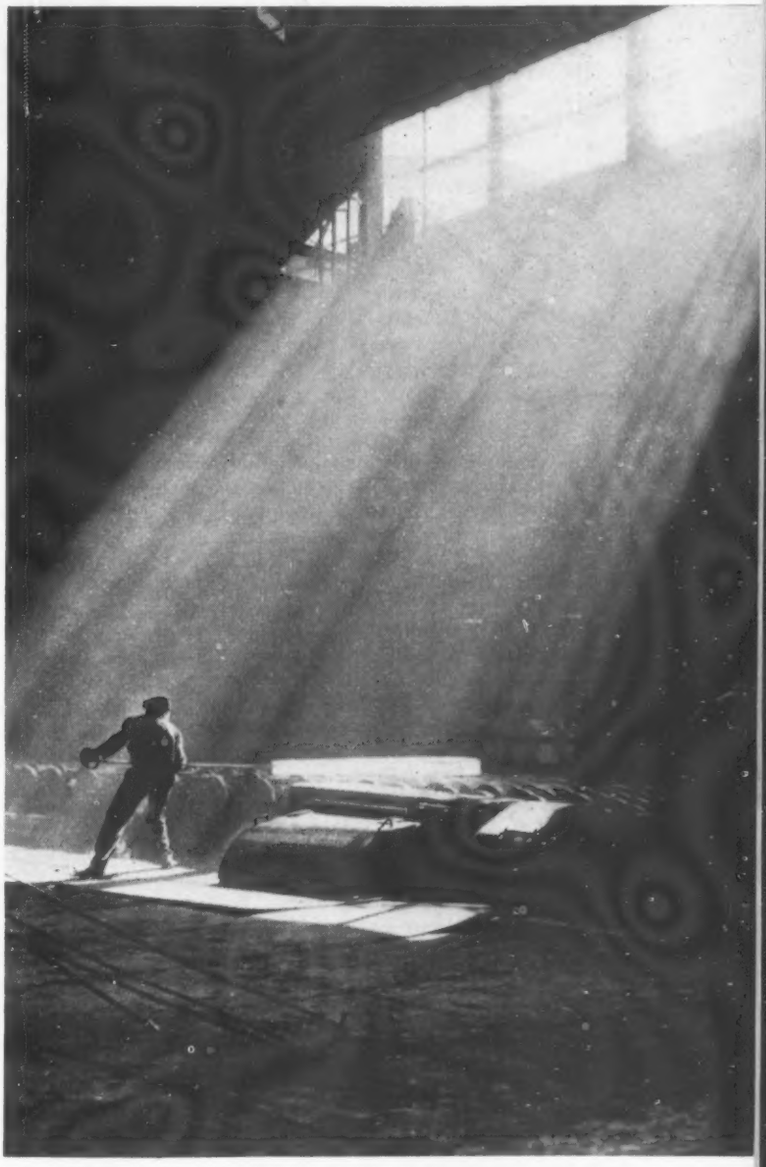
War requirements for zinc have made sharp inroads into the ore reserves of the Tri-State area of which Joplin, Mo., is the center but supplies are available from other areas of the United States and also Latin American countries. Electrolytic zinc capacity was expanded to provide for the expanded requirements of the copper and brass mills largely engaged in the production of cartridge brass. This high-grade zinc, however, can be readily diverted to the die casting industry for which a bright future is envisioned. The newer brass mills are expected to continue in operation after peace comes, probably as replacements for older less efficient equipment.

Growing future outlets for the war-born western steel and aluminum and magnesium installations are forecast. Industrialists in the West feel that it is high time to cut the moorings to the East and are leaving no stone unturned to persuade manufacturers to employ basic materials made in the West.

The West's new aluminum industry with nearly a billion pounds of virgin metal annually is an outgrowth of the war. The biggest problem will be to convert it to useful products and get these on the counters at attractive prices. No longer will it be necessary to ship pig aluminum to the East Coast for rolling and then return it to the West Coast for fabrication. The 4-high multiple stand mill at Spokane, Wash., will produce aluminum plates and sheets at the rate of 240,000,000 pounds annually and this is ample capacity for years to come. Recent studies disclose that the industrial market in the Middle West for aluminum is at least 50 per cent of the output of the five plants in Washington and Oregon.

However, ending of the war will bring with it the closing of 90 per cent of the aircraft factories and this will lead to a 60 per cent reduction in the output of aluminum. So the problem seems to be one of expanding industry rather than a return to prewar production schedules if widespread unemployment is to be avoided.

Outlook for magnesium appears promising despite its abundance made possible by wartime demands. Three distinct processes of reduction are being employed by the 11 producers of this light metal. About 40 per cent of the output is being used in the production of flares, incendiary bombs and the like; and about 35 per cent for aircraft needs in the form of castings.



During the rolling process the constantly thinning slab goes from one set of rolls to another. Here in an Alabama mill a workman is turning a slab so that it will enter the next pass broadside. United States Steel Corp. photo

Automotive industry faces reconversion task of first magnitude, but management has advantage of experience gained in switching over to annual new models

Automobiles

Civilia

FEW basic United States industries face a reconversion problem of the magnitude of that confronting the automotive industry, but by the same token few industries possess the inherent experience and skilled personnel comparable with that of the motor plants. Because of its policy of introducing new models each year, the motor industry tortures itself through at least a partial reconversion each summer and early fall as plant layouts are reshuffled, new dies, jigs and fixtures installed, new machine tools set in place and a broad list of parts and materials changes digested. Over the years these annual changeovers have come to be taken in stride and the skill of plant personnel sharpened accordingly.

Yet there has been nothing like the forthcoming conversion from war to peace production—even the hurry-up switch to war production three years ago. That was bad enough, but then cost was no consideration, time the essence. This year the problem must be tempered by cost considerations, even though time is still a paramount issue since all efforts are being made to avoid excessive interim unemployment.

Throughout 1944, the automotive industry spokesmen protested long and loud over the government's failure to recognize the need for what they called "pre-reconversion" planning. They agreed 100 per cent with the contention that nothing in the way of reconversion could be allowed to interfere with war production, but they disagreed violently with the premise that only partial or "spot" authorization of pre-reconversion activities could be sanctioned if interference with the war effort was to be avoided.

The motor industry's thinking on the overall job divides itself into four principal phases: Planning, pre-reconversion work, partial reconversion of plants, and resumption of partial car production.

In respect to the planning phase, much has already been accomplished. Decisions have been reached on what designs will be built (duplicates of 1942 models with numerous minor exterior refinements), orders have been placed for thousands of new machine tools and related production equipment, orders have been entered for most essential materials and parts, etc.

V-E Day Expectations Too Optimistic

Until recently, most Army procurement programs were based on expectations that V-E Day would come about March 15. Military developments lately make this date appear to be overly optimistic. However, if an adequate contract termination and reconversion program were to be realized by March 15, then all advance decisions and work incidental to clearing plants, except for the final count of inventories and their removal would have to be expedited. This would be a challenging task, the scope of which can be suggested by a few figures showing the extent of the problem for just one company—Packard.

This company operates a highly integrated automotive facility comprising foundry, forge shop, stamping plant, body shop, machining divisions and assembly lines concentrated in a single area, together with facilities for painting, trimming, heat treating and related processing. Without exception, every piece of machinery and equipment previously devoted to car production has either been moved out or relocated for the benefit of war production activities.

Prewar machinery and equipment included, for example, 3900 machine tools, 2000 of which were adapted and used on war contracts, 300 sold outright to others for use on war contracts, and 1600 moved outdoors for storage. The latter will have to be overhauled, with dust and dirt and damage caused by the burning of protective covers, ignited by a passing locomotive, forcing fairly complete reconditioning.

To the 2000 company-owned machines used on war production were added 8000 government-owned machines, bringing the present total in operation to well over 10,000, plus incidental equipment such as conveyors, racks, benches, etc. Every single piece of this equipment will eventually have to be moved (some of it already has been cleared to make small space available for production of a few replacement parts). All machines, except those the company owns and those it may determine to buy from the government to replace its own equipment worn out during the war, will have to be skidded, greased, cleaned, oiled, packed, crated and loaded for removal to some storage depot. Furthermore, $20,000,000 worth of government-owned special tools, jigs, fixtures and gages will have to be checked over and disposed of; presumably they will also have to be cleaned, oiled, and packed for shipment.

In addition, $1,600,000 worth of government-owned standard tools such as drills, taps, dies and the like will have to be inventoried and disposed of, and they will not find a ready market because most of them are odd sizes and lengths. Parts for two aviation-type engines in process will amount to approximately $56,000,000 worth. They will have no conceivable application in an automobile plant. One of the engines being built for war has 14,000 component parts, the

Civilian and military trucks roll off the assembly line at the Dodge plant of the Chrysler Corp.

other 9000. As yet, the company has received no instructions as to what will be done with these parts in inventory, but it would certainly like to know.

Many road blocks are discernible along the plant clearance and inventory disposal highway. A major one is the divided authority and responsibility of various government agencies. Will the Office of Contract Settlement and the military procurement agencies have final authority, or will it be transferred to the Surplus War Property Board? Will permission be extended contractors to "group" various claims to pass them up the line for settlement, or will it be necessary to wait for all claims to be submitted at a given level? Will complete cost information be demanded in connection with inventory lists filed for purposes of property disposal? Where will final settlement authority rest among the procurement agencies? Why cannot contractor-owned machines usable in civilian production be released from war work if they can be replaced by existing surplus government - owned equipment? When will tentative cancellation schedules be worked out and delivered to contractors? Where, specifically, will government-owned equipment and materials be shipped for storage?

New machine tool requirements of the automotive industry, even if only a partial resumption of production is to be effected, are of paramount importance. An entire department or plant can be kept idle for the want of a handful of "key" machine tools. Orders have been placed with equipment builders for most of these tools, but delivery promises either are vague or deferred far into this year. There have been a few deliveries on some standard tools on this "key" order list, but in many categories the outlook is next to hopeless. Consider the following:

Automotive machine tool requirements for partial reconversion are equal to approximately one month's production by the machine tool industry at its current rate ($40,000,000 per month) and 10 days' production at the peak rate in effect over a year ago ($132,000,000 per month). Employment in the machine tool industry has declined more than 35 per cent. Yet 25 per cent of the machine industry's capacity at its current level is reserved for lend-lease orders (whether military or not) and the remaining portion is reserved for military requirements in this country. This arrangement apparently will continue to July 1, which means that the automotive industry must look for its initial requirements in that part of the military program which is not fully utilized, since lend-lease carries priority over everything except military programs in the U. S.

Delay Seen in Filling Needs

The way it looks now, the automotive industry will not be able to fill its requirements for essential machinery to resume production until after July 1. The remedy which has been suggested is to place production of machinery essential for partial reconversion ahead of everything except machinery required for urgent military programs.

Another essential preparatory phase of automotive reconversion is the procurement of essential tools, dies, jigs and fixtures. Open capacity already exists in many of the hundreds of automotive tool and die shops, and their employment level has declined 20 per cent in the past year.

By A. H. ALLEN
Associate Editor, STEEL

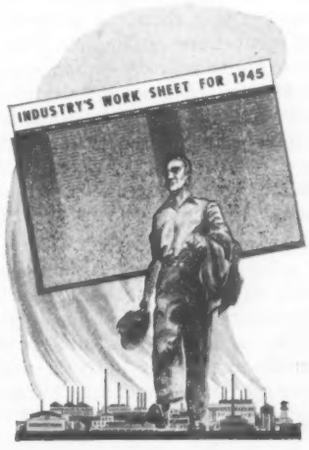
This brings up the serious question over the wisdom of permitting production of pots and pans, clothes hangers, bicycles and the various other end products now approved before giving consideration to the necessary pre-reconversion requirements of basic industries like the automotive plants. Essentially the problem is one of equitable distribution of available manpower.

To prepare adequately for automotive reconversion, it has been estimated the various manufacturers, the machine tool industry and the automotive tool and die industry might require a peak of 17,000 men for a period of five or six months.

After that time, only a few of these will be needed, their job then being to complete long-cycle reconversion tasks, like the building of large presses to replace equipment used in the war work.

Summarizing the recommendations of the combined automotive industry, expressed less than two months ago, the government is urged, first, in the interest of the war effort and, second, in the interest of peacetime jobs, to establish immediately a policy by the Director of War Mobilization and Reconversion, permitting individual manufacturers freely to undertake pre-reconversion activities which do not interfere with war production programs. This work should be given priority ahead of everything except the military programs of the United Nations, and the policy should apply to all converted industries, at the same time requiring the compliance of all government agencies.

It has been said with considerable logic that any planning, however inadequate it may prove to be in the light of actual events, is better than no planning. If this be the case, then the motor industry has made important steps toward achieving a smooth resumption of automobile manufacturing. Each day's passage obviously brings victory one day closer, and each day's advance planning can make that victory and the ensuing peace all the more complete.



Aircraft

Designer's drawing shows the huge new DC-6 recently announced as the principal peacetime plane to be built by Douglas Aircraft Co. for the major airlines

EMERGENCE of air power as a dominant force in modern warfare is perhaps the most comforting portent of the future to lugubrious aircraft manufacturers who, having seen their industry catapulted from forty-fourth position in the national economy to the top of the heap under the impetus of war, now face the cumbersome task of "shrinking" their plants, rather than reconverting them, to a reasonable level of peacetime production. This reliance on future military orders essential to maintenance of a strong air force in the midst of peace is a seeming paradox, yet in it may lie the actual insurance of enduring peace. The question is how long future generations may continue to understand the lessons learned since 1939.

Under forced draft, the aircraft industry today employs better than 2,000,000—half in the plants of less than 100 basic manufacturers and half in the plants of 162,000 subcontractors and vendors. The combined industry today is producing three-quarters as much as all American industries turned out in 1940. The most sanguine of aviation postwar dreamers is hoping for not more than 10 per cent of today's business, and he figures he can make a profit even at that reduced level.

Steps toward the maintenance of strong air power are fairly simple. As outlined by leading manufacturers, they are:

1. Advance the design of all types of aircraft and produce new designs, at least in limited quantities.

2. Continue training of combat crews and ground personnel.

3. Extend meteorological and navigational knowledge and facilities.

4. Improve aircraft engines and instruments.

5. Increase landing facilities and extend commercial airways.

6. Provide funds for continued research and development.

7. Improve materials and simplify manufacturing procedures.

8. Maintain jigs and tools; keep adequate stand-by production facilities in readiness.

9. Continue to employ as many as possible of the thousands of skilled workers in aircraft manufacturing plants.

10. Plan for continuation of aircraft manufacturing industry on a sound, profitable, privately-owned basis while efficiently serving postwar aircraft needs.

A fundamental but all-important difference is apparent between aircraft manufacture and many other lines of industry which have converted to war production. The latter can, when the war demands recede, convert to their normal manufacturing pattern and meet a waiting market for goods the like of which has never been experienced. Not so aircraft manufacturers who must depend on a vigilant government for continuing military orders—on a greatly reduced scale—and at the same time aggressively cultivate the unknown postwar market for commercial and private aircraft which even the most optimistic forecasters consider will be puny alongside the tremendous production totals of the past four years.

So, beyond all question, the first problem confronting the aircraft industry is demobilization—of manpower, machinery, materials and markets. Of these, by all odds the most concern now is in regard

Aircraft industry, catapulted from forty-fourth to first position in national economy by war, will be shrunk to not more than 10 per cent of present size when peace comes. Demobilization of men, machinery and materials to be difficult

By A. H. ALLEN
Associate Editor, STEEL

to manpower, in view of the emphasis being laid on postwar jobs.

Financial position of aircraft builders, despite booming production figures, is far from being well enough upholstered to cushion the impact of impending demobilization costs. As industries go, it is still a youth, on whom the burdens of manhood have been suddenly thrust. Lack of time, lack of sufficient personnel, lack of freedom from wartime controls which in many respects bear inequitably on plane builders, contribute to the dilemma. Working capital has increased, but the rate of net profits on sales is generally at low ebb. Here is a comparison of various industries, including 24 major aircraft and parts manufacturers, worked out by the National City Bank of New York:

Net Profits on Sales, 1943, Per Cent

Nonferrous metals	9.0
Petroleum products	6.8
Automobile (including aircraft sales)	3.2
Railway equipment	3.1
Iron and steel	2.8
Aircraft and parts	1.8

And even at this low level, a substantial part of the bookkeeping profits of aircraft builders is not in the pockets of stockholders but rather still in the business, largely in the form of inventories and other properties subject to drastic and possibly overnight shrinkage in values. Consensus of estimates indicates the entire net current assets of the industry would not equal one month's operating costs at present production rates.

Occupy Major Attention

Those war-end handmaidens, contract terminations, cutbacks and disposal of surpluses and inventories—have occupied a major share of the attention of aviation planners. In the first place, the industry feels there should be considerably more co-ordination of cutback programs between the Army and Navy, and this appears a sound contention since in the end it would reduce cost to the government of excess inventories of parts in process and raw materials, by permitting manufacturers to develop closer co-ordination between production schedules and materials purchases. The same unity of production planning as developed by the Aircraft Production Board might go far toward expediting aircraft demobilization.

In the second place, once contract cutbacks have been determined by the military, there are ten suggested yardsticks which might aid decisions on what company is to be cut and by how much. They are:

1. Aircraft cutbacks should be effective first for those temporary aircraft manufacturers (such as the automobile industry) which have assured postwar markets awaiting them.
2. Problems of the creator of the original airplane design should be given consideration in deciding which manufacturer is going to be cut back first—licensee or licensor.
3. Present production status of manufacturers concerned is a key factor.
4. Local manpower situation is important.
5. Overall costs of the products to the government logically calls for recognition.
6. Manpower utilization is a significant item.
7. Meeting of production schedules must be considered.
8. Contributions to progress of aviation are worthy of recognition.
9. Needs of the aircraft industry to prepare for postwar development and production should be acknowledged.
10. Orders for aircraft which are becoming obsolete should be cut back before orders for aircraft of more advanced design and of greater tactical utility.

Advance Notice Necessary

The aircraft manufacturing cycle, from raw material to finished work, varies from 60 to 120 days, so unless cutback notices are received this far in advance, the military procurement agencies will have contract settlement problems with quantities of semifinished parts of indeterminate value.

This leads to the matter of surpluses—plants, materials and airplanes. As far as aircraft plants are concerned, few if any of them are readily convertible to non-aircraft types of production. There may prove to be some exceptions as in the case of the Ford Willow Run bomber plant which according to reports may be converted eventually to tractor or automobile body production. In any event, there will be scores of large structures built during the war for aircraft assembly operations that seem destined either for dismantling or for use as standby or storage depots.

On this score, the industry feels each company operating a government plant—and that covers just about all the major manufacturers—should be given an opportunity to buy or lease the plant at reasonable terms for use. However, if after a reasonable period of time, the manufacturer has not concluded arrangements for purchasing a government plant, it should be offered to others. On the chance the plants cannot be used by either the original operator or by others, it is recommended they be kept under private management as standby plants for defense purposes; further that these plants be made available for use by their present occupants as warehouses for surplus materials acquired by the government as a result of contract terminations, but under no circumstances should they be operated by the government.

Disposal of surplus aircraft materials has been considered of such vital importance that aggressive steps have been taken in the past year under direction of Wright Field to speed the movement of surpluses in steel, copper, aluminum, hardware and components back into use in aircraft manufacture. Briefly, the plan worked out is for contractors with surpluses on hand to list them with the Metals Reserve Corp. which in turn offers them to a group of specially designated aircraft materials distributors who resell them on a commission basis at full market price.

Thus far, this practical program has little more than gotten under way, total declared surplus materials aggregating something like $25,000,000, but in principle it is sound because it proposes to return surpluses to production through established business channels and with all possible speed.

No one knows the extent of surpluses which will exist after the war. There have been roughly 250,000 airplanes of all types built in this country in the last four years. Suppose half of them are written off as worn out, combat losses, lend-lease or whatnot, and a mighty fleet of 125,000 trainers, fighters, bombers, transports and observation planes still remains. Stack this up against the few thousand commercial and privately owned planes which have sufficed to handle air travel in this country in recent years!

In conclusion, it appears the aircraft manufacturing industry is laboring under no delusions that today's all-out production can be any measure of its peacetime output level. Nor is it considered even remotely possible that a strong military air force can be maintained and improved without a large program of research, development and building.

Shipbuilding

United States, with two-thirds of world's merchant ship tonnage, will cut back construction sharply after the war. Eight hundred thousand tons annually generally believed top figure for post-war years. Disposal of surplus vessels and yards poses large problem

By W. J. CAMPBELL
Associate Editor, STEEL

SHIPBUILDING, leading consumer of steel during World War II, probably will be confronted with the most difficult reconversion problems of any of the metalworking industries.

The problem is obvious. American shipyards, comparatively free from danger of attack and having available the tremendous output of American steel mills, have produced an outstanding tonnage of merchant shipping. When peace returns we will have produced—less losses—a fleet aggregating 50 million tons, four times our prewar tonnage and about two thirds of all the tonnage afloat in the world.

A large proportion of this tonnage will be surplus. The most optimistic observers predict that merchant ship construction will drop from a peak of more than 19 million deadweight tons in 1943 to approximately 800 thousand tons annually.

Steel Requirements to Recede Sharply

Steel requirements of the shipbuilding industry, which for the past two years have been about one-fifth of total production, will recede to relative prewar unimportance.

A large proportion of the nearly three quarters of a million shipyard workers will be dislocated.

The vast war-born facilities, most of which are government-owned, will present a troublesome surplus problem.

The expansion of American shipbuilding long will stand as one of the wonders of the world. In 1938 the Maritime Commision launched an ambitious program for building 50 ships a year. The following year the goal was raised to 100; in 1940 to 200; in 1941 to 400; and with our entry into the war the lid was just taken off.

Actual production since 1936 has been:

Year	Vessels	Deadweight tonnage
1936	9	107,938
1937	18	194,788
1938	25	289,765
1939	28	341,219
1940	55	641,056
1941	99	1,137,163
1942	746	8,089,732
1943	1,896	19,238,626
1944 (11 mos.)	1,532	14,986,538

This represents an investment of $18 billion, more than the government has invested in war plants, machinery and equipment, and nearly three quarters of the investment in railroads before the war.

At the close of 1944 the American merchant fleet consisted of about 2500 Liberty ships, more than 400 C-types; about 500 ocean-going and coastal tankers, approximately 500 Victory ships; plus a large number of vessels built for special purposes. In the aggregate these vessels have a deadweight capacity of 50 million tons.

Obviously a large proportion of this tonnage will become surplus when peace returns, and the problems of its disposal will be difficult.

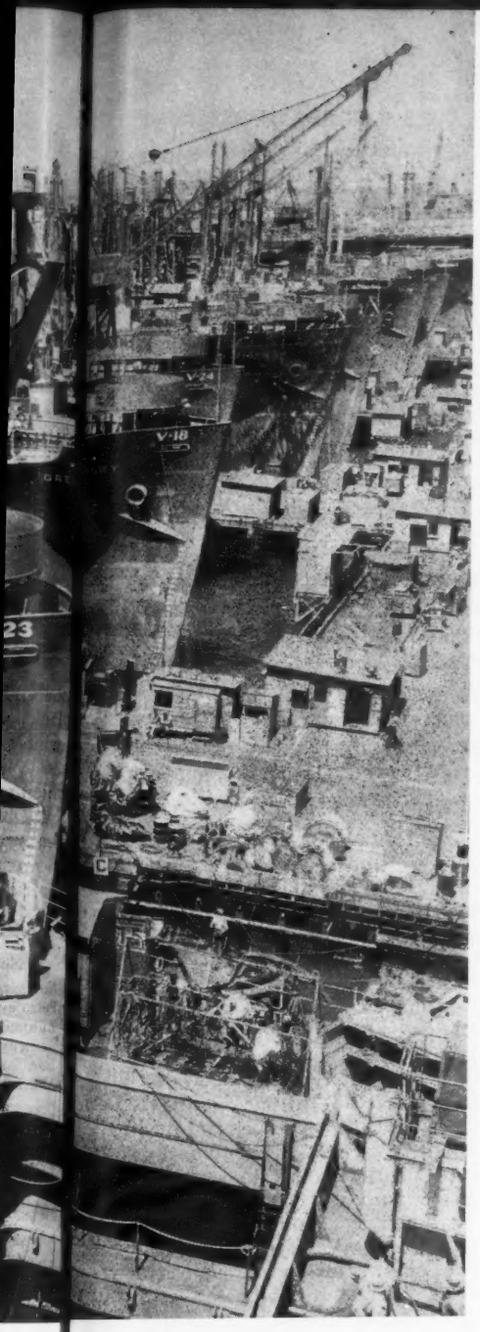
Vice Adm. Emory S. Land, chairman of the Maritime Commission, believes the American merchant marine can utilize 15 to 20 million tons of shipping during peace years. Not all of this tonnage would be engaged in foreign commerce. Normal peacetime requirements incident to domestic transportation necessities would absorb a considerable volume of tonnage.

Great Lakes shipping, according to Admiral Land, will have a peacetime requirement of approximately 3,500,000 deadweight tons. River requirements will be about 2,500,000 tons, while coastal and inter-coastal transportation will require 3,800,000 tons.

This would leave about 7,500,000 tons for foreign trade, compared with 4,000,000 tons in prewar years.

A substantial proportion of the remainder of the merchant fleet probably will be maintained "in sanctuary" as a national defense reserve. Admiral Land estimates it will cost three to four thousand dollars a year to maintain a ship in sanctuary. In other words, 1000 ships can be maintained in good condition for four million dollars a year.

Even allowing for an expanded merchant marine and a stand-by fleet in reserve for national security reasons, there will remain an excess of tonnage. Part of this may be disposed of through sale, lease or charter to the normal maritime nations which have lost a considerable tonnage of their prewar shipping. Great Britain, Norway, the Netherlands, France and Greece are known to be eyeing the



Victory ships, large and fast, were produced in increasing quantity last year. This type of vessel, shown here in a West Coast yard, will figure prominently in the postwar merchant marine. NEA photo

United States ships enviously and will be interested in acquiring them if suitable disposal terms can be arranged.

The Maritime Commission has recommended to Congress that the wartime fleet be disposed of as follows:

1. Ships more than 20 years old should be scrapped.

2. Between 500 and 2000 vessels should be laid up in sanctuary.

3. Surplus vessels should be offered for sale or charter to American shipping lines.

4. Offer for cash sale in this country to members of the United Nations any Liberty vessels not laid up or disposed of by other means.

Traditionally, American shipbuilding costs have been much higher than those of foreign yards, due to higher labor rates. Prewar costs of American yards often were as much as twice those on the Continent.

During the war, mass production methods have reduced costs sharply. However, when mass assembly methods are dropped and shipbuilding reverts to specially-designed vessels, it is probable that American yards again will be at a disadvantage costwise.

The probable 800,000 tons that will be built yearly after the war will be tailor-made vessels, largely for coastal or inter-American operations.

The cutback in steel consumption in shipbuilding already is apparent in steel consumption statistics. Whereas ships required nearly 20 per cent of total 1943 production, 11,432,813 tons of finished steel, 1944 consumption has dropped from 3,220,901 tons in the first quarter, 20.7 per cent of production, to 2,724,970 tons in the second quarter, to 2,321,457 tons, 15.5 per cent of total production, in the third quarter.

New Type Ships Developed by War

The war naturally has brought about the development of new types of ships. Among these have been:

1. The Liberty, the first ship to be produced in mass quantities. It has an overall length of 441½ feet, beam of 57 feet, deadweight tonnage of 10,800, all-welded steel hull, a reciprocating steam engine and speed of 10 knots. About 2500 are in stock.

2. The Victory. Length is 445 feet, beam 62 feet, deadweight tonnage, 10,800, turbine-gear propulsion; speed, 15 knots and up. Over 500 already constructed and expected to be a major factor in postwar fleet.

3. The C-I. Length is 413 feet; beam, 60 feet; deadweight tonnage, 7500; oil-fired boilers driving high-speed turbines; suitable for use on minor trade routes.

4. The C-2. Length, 459 feet; beam, 63 feet; deadweight tonnage, 9000; choice of diesel or turbine propulsion; speed, 15½ knots up. This model has modern cargo-handling equipment and provides a balance of speed, cargo capacity and economical operation for foreign trade service.

5. The C-3. Length, 492 feet; beam, 69½ feet; deadweight tonnage, 12,000; turbine or diesel propulsion; speed, 16½ knots; may be converted into passenger vessels with minor alterations.

6. The C-4. Length, 523 feet; beam, 71½ feet; deadweight tonnage, 14,560. Only few of these have been completed.

7. The P-2. A passenger ship with a long cruising range developed especially for service in the Pacific theatre of operations. This vessel is 609 feet long, has a beam of 75 feet, and a power plant generating 18,000 horsepower.

Both the C-4 and the P-2 are recent developments and are expected to figure prominently in postwar shipping.

8. Tankers. Several models of tankers were built by the Maritime Commission, many for private companies under government subsidy.

Of the above types, the tankers, the C-type vessels, the Victories and the P-2s probably will be utilized in the postwar merchant marine. The Liberty ships probably will be assigned to the standby fleet or written off as a loss.

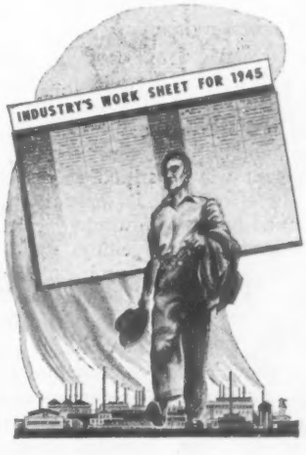
In addition to the vast tonnage of merchant shipping constructed since the war started, American yards have turned out a variety of naval and special purpose ships. Naval construction last year amounted to approximately three and a third million tons, including a variety of fighting ships, details necessarily of which are guarded.

An innovation of this war has been the many types of landing craft, including amphibious tanks. Among the most interesting of the invasion craft have been the LSTs (landing ship tank), a 328-foot ugly duckling which has been used to put United States troops ashore in both Europe and the Pacific islands.

Greatest expansion during the war has been in West Coast shipyards, which now are producing slightly more than one third of the total tonnage being built. The Pacific yards probably will be the last to feel the pinch of reconversion, as it is estimated that the war against Japan, after Germany is defeated, will require three times the number of ships now being used in the European theater.

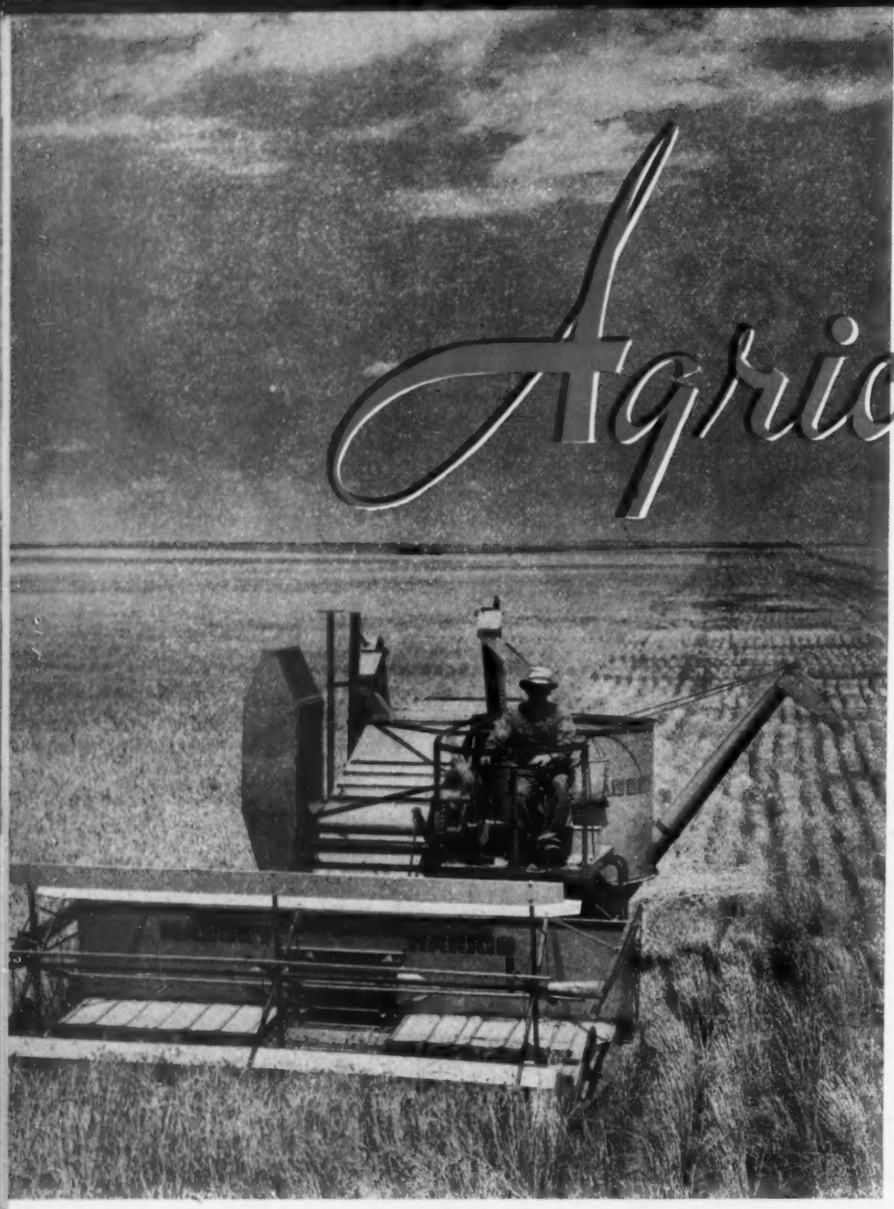
Gulf Coast yards also experienced a large expansion and now produce nearly 30 per cent of the total tonnage. The established yards on the Atlantic have expanded moderately and account for approximately one-third of the total tonnage. Great Lakes yards have been building smaller ocean-going vessels which have been delivered by way of the St. Lawrence or the Mississippi.

Repatriation of troops, movement of supplies and equipment and rehabilitation work will engage a large portion of the merchant fleet for at least six months and perhaps for as long as three years after Japan is defeated, according to government officials. Sea transport for all-out war against Japan may require three times the shipping involved in the European war, according to the War Shipping Administration.



By ERLE F. ROSS
Associate Editor, STEEL

Agriculture



This self-propelled combine for grain harvesting is one of the newer specialized farm machines. Trend in production of self-propelled combines, as well as other farm equipment, is to build small sizes, thereby increasing the number of farms on which they can be used practically and economically

END OF THE WAR in Europe, which will bring with it an easing of government control and an end to manpower shortage, promises to provide for the farm machinery industry several years of sharply expanded output, an opportunity to explore new markets for new products, and prospects of extremely keen competition. Whether this will come about early in 1945 or later depends upon the speed with which the Allied military forces achieve victory.

Reconversion from war to peacetime basis will not be complex nor time consuming. Although the industry has engaged heavily in the production of ordnance and other war materiel, farm equipment was classified as essential to the war effort and its output has been continued but on a restricted scale. Prewar manufacturing facilities stand essentially intact and the problem is one of remanning them and securing adequate supply of materials to return to full capacity operations.

To provide for production of war goods, most farm machinery makers were supplied with plants by the government or facilities were installed in available space, such as warehouses, without interfering with regular production. When these are closed down, it will involve little more than turning the plants back to the government or moving equipment out of privately owned property.

Contracts for production of war goods have been undergoing progressive cutbacks in recent months and in some instances have been terminated. The pattern for contract termination already has been fairly well established and the winding up of contracts still on books is not expected to involve unusual difficulties either from an operational or financial standpoint.

Likewise, the industry anticipates no hitches in getting its products into the hands of consumers as output returns to normal proportions. Factory branches and distributor organizations largely are intact and can be restored to their full stature as necessity requires and manpower becomes available.

A tremendous unsatisfied demand for farm equipment exists and a greatly expanded market seems certain after the war. During the 18 months following United States entry into the war, the government held production of farming machinery to a low level, yet at the same time called for maximum agricultural output. As a matter of fact, the farm equipment industry was the original guinea pig of the war effort. Discovering its short-sighted policy in limiting the manufacture of equipment too drastically, WPB raised quotas substantially for the year July 1, 1943, to June 30, 1944. In the meantime, however, demand for iron, steel and other metals for production of war goods had grown to such heights that the farm machinery program was about 10 per cent short of its goal by end of last June. A grace period through July on most items and through September on a few farthest behind saw the original quotas essentially fulfilled. Despite production handicaps, the American farmers probably received about twice as much equipment in 1944 as in 1943.

Production quotas for the year beginning July 1, 1944, were set at about the same level as the previous year and WPB earmarked approximately 1,000,000 tons of carbon steel and corresponding amounts of other materials for manufacture of domestic farm machinery to make the established quota possible. At midyear metal supply was improving month by month and there was every indication the industry was "out of the woods." But by fall, manpower shortage had become a bottleneck, and with prolongation of the war in Germany, grew progressively more acute. Coupled with this, the need for more munitions and war goods created metals shortages in certain categories, such as malleable, gray iron and steel castings and components. Thus once again, the farm equipment program is suffering curtailment.

In the first four months of the 1944-45 program, ended Oct. 31, farm machinery production fell far behind manufacturer's schedules. WPB blamed manpower

Farm machinery industry expected to start at end of European war on a several-year period of sharply expanded production, exploration of new markets for new products, and extremely keen competition. Reconversion will be relatively easy because prewar facilities are intact

shortages and difficulty in obtaining components, particularly malleable and gray iron castings, due to urgent military requirements. Each of 20 items was behind schedule. Production of corn, cotton and potato planters failed to meet quota by 50.1 per cent, while output of manure spreaders was 52.6 per cent below. Smaller percentages were reported for other implements.

The program calls for about 364,000,000 acres in various crops, compared with 360,000,000 acres planted last year. Recommended is a 3 per cent increase in the spring pig crop, 2 per cent in milk production, and 3 per cent in slaughter of cattle and calves, but a 16 per cent decrease in egg production. To encourage continued heavy output, the government will provide farm price supports or guarantees at about the same level as last year. This is contingent upon Congress' approval of an administration request for $2 billion increase in funds for the Commodity Credit Corp.

Farm cash income from marketings in 1944 are estimated at $19,400,000,000, a new all-time high exceeding the previous record of $19,252,000,000 in 1943 by 0.8 per cent. These compare with $15,374,000,000 in 1942 and $11,157,000,000 in 1941. Government payments in 1944 appear to have reached a record total of $850,000,000, an increase of 26 per cent over the $672,000,000 in the preceding year. Previous record was $807,000,000 in 1939. Comparisons were $697,000,000 in 1942 and $585,000,000 in 1941. Since the farmers' income rose faster than the prices they paid, buying power of cash income was in the order of $22,275,000,000. This closely approximated the 1943 figure of $22,713,000,000.

Huge Reservoir of Future Business

Thus, it can be seen that the farmer is in a position financially to replace his obsolete farm machinery and to buy additional equipment. He would be doing so today were it available to him in adequate quantity—in the meantime the unsatisfied portion is serving to build up a huge reservoir of future business.

Despite the serious shortage of farm equipment during the past three years, the War Food Administration effective July 20, 1944, rationed fewer types of equipment. Subsequently, effective Sept. 28 all machinery except corn pickers were removed from ration control, and the latter were released in November.

In heaviest demand and hardest to get because production was far behind were combines, corn binders, corn pickers, manure spreaders, mowers, side-delivery rakes, hay loaders and pick-up balers. Wheel-type tractors ran close to production schedules throughout the year and were one of the few items that frequently ran ahead. This in spite of the fact that rubber tires were in short supply.

Farm mechanization is increasing currently and the trend in this direction in postwar is expected to gain impetus. Thus the demand for farm machinery can be expected to expand well beyond the proportions of merely replacing worn-out and obsolete equipment. Through his experiences during the war, the farmer finds that he must employ mass production methods to secure his future economic status. Having to produce large crops with insufficient labor supply has demonstrated this. According to the Department of Agriculture, the nation's farm population has slumped 4,748,000 in the last four years. The total in January, 1944, was 25,521,000, against 30,269,000 at the beginning of 1940. Half of the decrease occurred in 1942, when military service and the attractiveness of high wages in war plants made heavy inroads on farm manpower.

Farm Equipment Prospects

To get some appraisal of farm equipment prospects present and future, take the situation for just two items—tractors and trucks. Estimates indicated there were 2,000,000 tractors on farms on Jan. 1, 1944, and of these several hundred thousand needed to be replaced. Additional thousands are needed to replace mules and horses, for the population of these is said to be declining 250,000 annually. This creates a demand for at least 100,000 tractors a year. As for farm trucks, experts indicate that more than 500,000 are needed now merely to replace those which have been in operation more than ten years. Parallel situations exist for other types of farm machinery.

It has been known for some time that several new types of farm machinery have been developed and will be on the market after the war. These include field hay choppers, pick-up presses, mechanical sugar beet harvesting equipment, self-propelled combines, cotton pickers, cotton strippers, and new specialized equipment for smaller farms. The latter includes radically improved tractors and attachments. Specific details of these machines are withheld for competitive reasons but manufacturing intentions are not secrets. Also of interest is that one of the larger implement companies has announced intention to make a line of household refrigerators.

But, in addition to the old-line farm machinery companies, others, including some newcomers, appear to be making bold plans to cash in on the promising farm market of the future, both domestic and export. Because of the shrinking manpower on farms, the high wages which labor commands, and the trend toward mechanization, particularly on smaller farms, the prospects for garnering a share of the business look attractive.

A large automobile company, which has been a maker of tractors, has plans for transferring production to a large plant now used in turning out bombers, and to step up production of tractors and implements on a tremendous scale. The plan involves ambitious cultivation of the South American market. Another automobile manufacturer contemplates a new version of a farm tractor and probably a line of implements. A number of metal-working companies may become aggressive competitors in the implement and equipment field. One idea is to put rubber tired wheels on all present steel-wheeled vehicles, another is to make smaller threshing machines, combines and attachments. Recent merger of a large farm machinery maker with a large tractor builder has important connotations in the respective fields. It is not beyond possibility that some of the West Coast aircraft companies may explore the farm field; the drawback here, of course, would be the lack of outlets and suitable financing means, since most farm equipment sales require some form of time payment arrangement.

The foregoing suggests that the future may see some extensive new plant construction, this to provide new manufacturing facilities, to increase old ones, or to shift present facilities to new locations, the latter to gain competitive advantages through proximity to markets.

There is opinion that future possibilities in the farm machinery field are being overestimated. While labor saving is essential now, it must be remembered that even today there is overproduction in some farm produce, and it is being propped up by subsidies which cannot last indefinitely. The average farmer is making good profits currently but he may not be able to buy mechanized farm devices on a large scale in the years ahead. If, therefore, the market is drained in the first few years after the war by a number of ambitious new manufacturers, then the eventual deflation will be serious when farmers have spent their accumulated reserves.

By ERLE F. ROSS
Associate Editor, STEEL

Railroads

DISAPPOINTED again in 1944 in not receiving sufficient steel for new cars and trackage to make projected improvements, American railroads look to 1945 and perhaps even later for their requirements to be satisfied. The outlook was promising as last year began, but as the months passed by and the war lengthened in Europe, military demands for steel and growing manpower shortage forced downward revisions in allocations and slowed production.

In spite of the fact that acquisition of new equipment has fallen short of levels planned in all three wartime years, the carriers have utilized their facilities with an amazing efficiency and have established consecutive new traffic records. Freight traffic in 1944 aggregated approximately 748 billion ton-miles, an increase of 18 billion over 1943, and double that of 1940. Passenger load last year amounted to 96 billion passenger miles—eight billion more than in 1943 and four times the load in 1940.

Revenue carloading during the first 50 weeks of 1944 aggregated 42,737,534, an increase of 2.7 per cent over the corresponding period of 1943, and 1 per cent over 1942. It is apparent, therefore, that the year's total will approximate about 44,000,000 and will be the largest for any year since 1930 with 45,877,974. A point to bear in mind here is that car capacity today is well over 50 tons, compared with 46.6 tons in 1930. Total carloadings were 42,414,343 in 1943, 42,826,463 in 1942 and 42,289,764 in 1941.

One-Fourth Fewer Cars

The freight burden was handled with one-fourth fewer freight cars and one-third fewer locomotives than in 1918. Despite a reduction in freight cars of 600,000 units, traffic was handled without serious car shortages or loss of production time at factories. As for passenger service, this was performed with one-fourth fewer passenger cars and one-third fewer locomotives than in 1918.

Railroads have no particular reconversion problems to face unless their programs for equipment, roadbed and terminal modernization be so regarded. For two or three years no serious slump with widespread unemployment is anticipated. A threat, however, is the trend in the direction of more subsidies for rail competitors. A warning on this point has been given by Ralph Budd, president, Chicago, Burlington & Quincy railroad, and former railway commissioner on the old Defense Advisory Commission.

He points out that despite increased wages, high materials costs and fantastic taxes, the railroads have prospered on prewar rates, due entirely to the large volume of traffic. If the carriers are robbed of part of their traffic by subsidized forms of transportation, rail costs will increase. If, at the same time, rail rates are forced down by subsidized competitors it will lead to disaster.

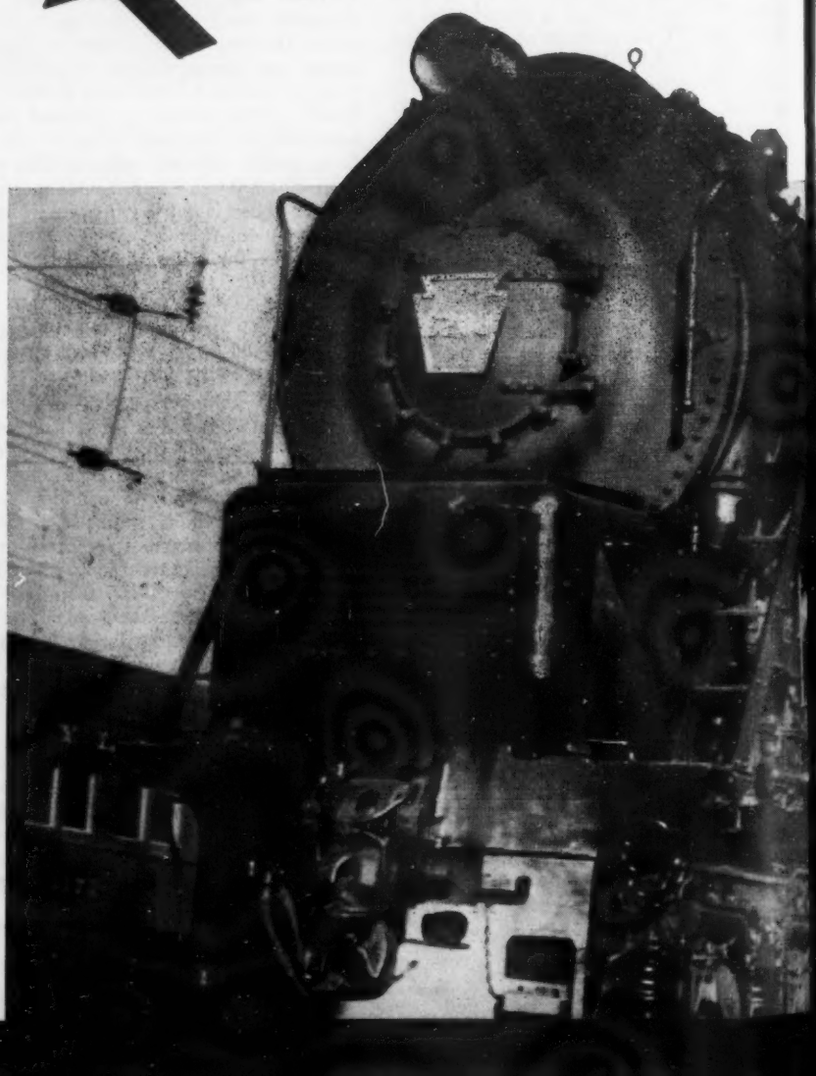
The railroads anticipate competition from air lines, trucks and private automobiles. They are inclined to admit that planes will take much of the transcontinental passenger business, but relative costs will give only a comparatively small portion of freight hauling to air lines. On shorter rides, the carriers will give added comfort for passengers and will retain the advantages of dependability and of downtown terminals.

For the balance of the European war, railroads anticipate heavy business, followed by a sharp tapering off. For up to 18 to 24 months during industry's reconversion, traffic of at least 25 per cent above 1939, which recorded 333 billion ton-miles of freight and nearly 20 billion passenger-miles, is anticipated. For three or four years after the reconversion period, business is expected to approximate volume in the 1929 boom year in which freight traffic was 447 billion ton-miles and passenger load was 24 billion passenger-miles. Based on revenue estimates, the carriers will employ 1,000,000 to 1,100,000 during reconversion, and 1,140,000 to 1,225,000 in the postwar years. Current employment is 1,400,000.

Already the railroads are preparing for postwar. In the first five years after Germany is defeated, they expect to invest $1750 million dollars in rolling stock and about the same amount in roadway betterments, terminal and incidental equipment. The latter certainly will include radio communications with locomotive cabs for traffic control.

Replacements in rolling stock will incorporate recent modernization in design and advancement in materials. This applies to freight cars in which light-weight metals—high-tensile steel and aluminum—and plywood are employed to reduce deadweight, as well as to passenger cars in which streamlining and decorations add to customer appeal.

Improvements also have been made in locomotives. Orthodox steam types have been improved and just a month ago, Baldwin Locomotive Works and Westinghouse Electric & Mfg. Co. completed for the Pennsylvania railroad a fundamental-



ly new type—a coal-burning, direct-drive, steam-turbine unit. It was designed to develop sufficient horsepower to pull a full-length passenger train at 100 miles an hour and freight trains at high speed. Tests will be watched with interest by motive power engineers. Diesel-powered electric drive units also are increasing in popularity both for passenger and freight service, and several new types have made their appearance.

In postwar, operating efficiency will take on its former prewar significance. With reduced traffic load and revenues, every advantage must be taken of economies which can be derived from operation of equipment. To stimulate business, both freight rates and passenger fares must be held to the lowest possible level.

Railroads entered 1944 with the best prospects for sufficient materials since the war began, because critical materials were easing. They were given assurance of sufficient steel to meet car and locomotive requirements, including promise of some passenger cars in fourth quarter. Likewise, they were assured of new Victory all-steel type freight cars in place of the composite steel-wood units which were not proving thoroughly economical. Prospect also was for at least 1,800,000 tons of new rails.

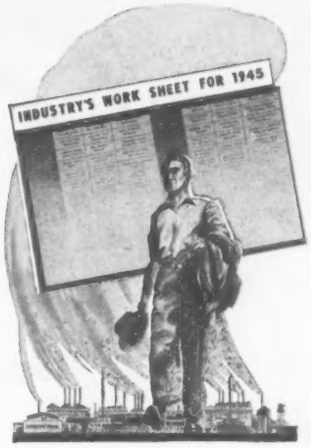
At the beginning of 1944, the freight car program was heavy with about 70,000 scheduled for the year. Of this total, about 30,000 were domestic and the balance for military service. Of the scheduled output of 68,000 cars, 27,000 for domestic and 41,000 for military, in 1943, builders failed to meet the quota by less than 5 per cent, or 3195 cars. Domestic freight car construction fell 2900 short of meeting the 1943 goal, while military car construction was only 295 short.

Domestic freight car awards in the eleven months ended Nov. 30, 1944, totaled 36,516, against 41,355 in all 1943; 26,028 in all 1942; and 121,499 in all 1941.

Domestic cars on order Dec. 1 amounted to about 36,400 with car shops also having on order a considerable number for the armed services. However, the War Department's orders for nearly 24,600 cars placed last summer were reduced sharply late in the year.

The whole export program has been set back and it is understood that whatever cars are not in construction on V-E Day will be canceled. Reason is said to be a surplus of Army rolling stock in the various theaters as well as at home. Placed in service by class 1 railroads in the first eleven months last year were 35,972 new freight cars. No new passenger cars for domestic service were built last year.

Also on order Dec. 1 were 495 new locomotives, including 90 steam, 2 electric and 403 diesel, compared with 1004 locomotives, including 387 steam, 3 electric and 614 diesel a year earlier. Installed in the first eleven months were 846, against 656 in the corresponding period of 1943.



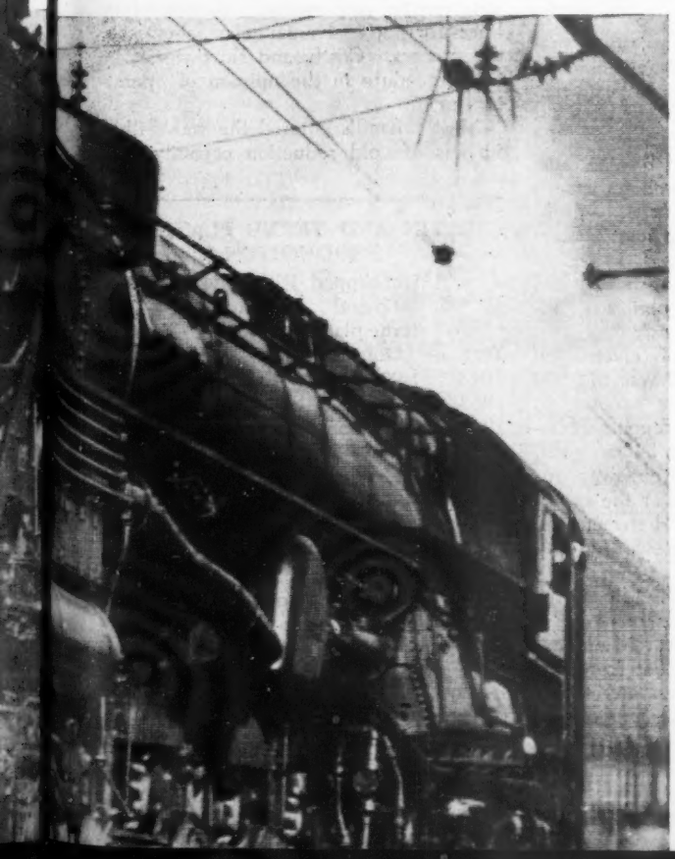
Controlled materials for railroads in first quarter, 1945, will be greater than allotted in fourth quarter last year, but less than requested by the Office of Defense Transportation. Material is available for 2300 box cars for delivery in second quarter, contingent upon placement of orders by carriers with car builders before Dec. 1, 1944. ODT requested the railroads to place orders for additional box cars for delivery in third quarter before Jan. 1.

American Association of Railroads reports that 25,000 freight cars already have been ordered for 1945 delivery and possibly as many as 55,000 will be on order soon. This will equal or surpass car builders' capacity to produce. It is asserted that the carriers could use another 100,000 freight cars and 15,000 to 20,000 passenger cars. Of present freight cars in service, 45 per cent are more than 21 years old, while of passenger equipment, 50 per cent is over 25 years old.

Although the carriers had asked 2,500,000 tons of rails in 1944, and were allotted 2,200,000 tons, the quotas were reduced in third and fourth quarters. Receipts aggregated approximately 1,500,000 tons last year. In 1943, the railroads received shipment of 1,538,984 tons of rails, while in 1942, 1,260,000 tons were received.

Most domestic roads have placed their requirements for 1945 with mills and government agencies so that the complete program can be mapped. There is little doubt that this year's tonnage will be substantially higher than last. The 1,900,000-ton production last year was about 80 per cent of the tonnage requested by all sources, including lend-lease, military and domestic. This year, requests for production may total close to 3,000,000 tons of thermo-treated rails. However, this will be pared down to somewhat over 2,000,000 tons. Of the 1944 requirements, some 325,000 tons went to lend-lease and military consumption, leaving about 1,500,000 tons for domestic.

Carriers hope to receive sufficient steel to make over-due improvements and modernizations during 1945. Wartime service has been outstanding despite shortages of equipment. Past year's freight traffic has been double 1940; passenger travel four times 1940 load



Pennsylvania railroad's new locomotive, just delivered, is powered by a turbine. This is the first of its kind built in the United States. NEA photo

Containers

Tin plate production expected to increase during 1945, but must await end of war and freeing of Straits supply of tin before output attains prewar levels. Substitutes necessitated by war unlikely to be retained when coating metal again becomes available in quantity

By L. E. BROWNE
Associate Editor, STEEL

TIN mill production for coated steel containers, which increased 465,000 tons last year, likely will register further gains in 1945. Heavier release of electrolytic plate by conservative modification of regulation M-81, affecting for the most part general line cans with lighter tin coatings, is indicated.

Not until tin is available in something like prewar volume, however, will tin plate and can fabricating industries shed wartime controls, permitting open competition, portending further trends in demand and establishment of electrotinned plate in a normal economy. This means after the defeat of Japan and freeing of Straits supply.

Downward trend, begun in 1942, after the peak previous year, has been reversed; general line cans are the chief beneficiary. Compelled to scrimp on tin, production is subject to artificial influences and will be for some time, regardless of any easing in steel supply which at times has been another factor in tin mill quotas. But the coating metal is the dominating consideration. Hot-dipped, electrolytic and bonderized are all affected.

Substitute materials for tin-coated steel containers are given impetus by necessary controls, but practically all materials formerly packaged, will return to this metal when production is unregulated and supplies are ample. Like some other steel markets opened to substitutes, tin plate will regain any ground lost in the field of packaging.

Tin mill quota for the first quarter this year, 900,000 tons, is 125,000 tons larger than in the fourth quarter 1944, of which 150,000 tons were for export. Production quotas by quarters last year were: 627,000 tons, first; 825,000 tons, second; 875,000 tons, third. Allowing for seasonal influence in the last quarter, quotas reflect a gradual easing in supply, carried into first quarter, and expected to continue as a trend this year, barring unforeseen developments.

Maximum annual potential capacity for hot-dipped and electrolytic tin and terne plate is 5,892,700 tons. This includes 3,718,850 tons of hot-dipped by nine producers, and 2,173,850 tons of electrolytic by ten companies. Peak year in the industry was 1941 at 3,509,399 tons, hot-dipped; electrolytic was no factor in this. On that basis, present capacity of hot-dipped was nearly filled during the peak period and for the most part any surplus capacity largely falls in electrolytic. The previous peak probably will be surpassed in early years after restrictions are removed, and division of tonnage between hot-dipped and electrolytic in the postwar period is subject to much conjecture.

Estimated production of electrolytic during the year just closed was 631,000 tons, this branch operating around 30 per cent of capacity; hot-dipped at 1,993,000 tons operated near 54 per cent. Increase in electrolytic output was approximately 303,000 tons over the previous year, but the spread between the two operating rates is noteworthy and significant.

Utilization of electrolytic lines for the coating of other metals on steel is subject to considerable research and experimentation. As pointed out frequently, the steel industry has an investment of about $50 million in these units and any further developments promoting flexibility of the equipment is of importance. Coating of zinc is mentioned and the War Production Board seeks data as to employment of electrolytic lines for the galvanizing of sheets by the process. Costly and slow would be this procedure in the opinion of operating men.

Most tin mills entered the war with a surplus of cold reduction capacity over finishing or coating. This has been reversed with advent of electrolytic capacity which accounts mostly for an increase in coating facilities approximating nearly 1,590,000 tons in less than two years.

The true capacity of the industry may

TIN AND TERNE PLATE PRODUCTION

Year	Hot-dipped tin and terne plate tons	Electrolytic tin and terne plate tons	Total tons
1944..	1,993,315*	631,068*	2,624,383*
1943..	1,830,138	329,823	2,159,962
1942..	2,644,653	82,426	2,727,079
1941..	3,509,399	.....	3,509,399
1940..	2,738,581	.....	2,738,581

*Estimated.

School children load salvaged cans into a freight car to be shipped to a detinning plant. NEA photo

well be that of strip tandem mills in tin mill gages, No. 29 or lighter. Capacity of these mills is likely to be taxed more than coating facilities in expected heavy demand for cans in the postwar period. Total annual capacity for electrolytic plate will ultimately approach 40 million base boxes. In the peak year, 1941, about 20 million base boxes were required for general line or non-thermally processed products. The lift in demand for general line cans is expected first, primarily because of the less tin required, and may become progressively higher. Obviously electrolytic capacity will be large enough to meet all demand for general cans and still have capacity left over. What dent electro-tinned plate makes in packer or processed food containers would naturally be at the expense of hot-dipped.

Increasing requirements for beer and military rations are pronounced; both will take more steel this year, exceeding the 38,773 tons used for beer cans in 1944, and the 98,715 tons used for military rations. Bulk of the tonnage for beer was consumed in the last three quarters and the trend will be upward this quarter. Another heavier minor pack includes fish and sea food products. Fruits and vegetables are, of course, old-time leaders, although individually condensed and evaporated milk is the leader, taking 310,407 tons.

Resistance in opposition to the proposed use of 0.75-pound plate for milk has been apparent by dairy interests, but canmakers feel this coating would be satisfactory providing the pack was moved expeditiously and not kept in storage too long. A change to the lighter coated plate would naturally mean a substantially heavier volume for electrolytic lines.

Heavier production of tin and short terne plate is not increasing consumption of tin in the same ratio, evidence that the conservation policy is fruitful. For these products 23,850 tons were consumed last year compared with approximately 22,000 tons in 1943; roughly electrolytic required about 3475 and 1800 tons in the two years. Average weight of tin coating is also lighter. Average weight per base box will be close to 0.95 plus this year against 1.06 a pound last year. Bronze has easily assumed the lead in tin consumption since the conservation program. Production of chemically treated black plate is running about 125,000 tons a year against a capacity of 464,000 tons.

Savings with 0.50-pound electrolytic plate for processed food cans are partially canceled by inside enameling; external corrosion resistance is not as good as plain hot dipped 1.50-pound and canmakers hold electrolytic plate must be improved for processed food products without need of inside enameling if substantial acceptance is forthcoming for thermally packed materials, or packers' cans.

Short service life attends most foods in unenameled 0.50-pound electrolytic plate, but research offers prospects for improvement. Corrosion tests with plain cans fabricated from plain plate selected at 10-minute intervals from normal production reveal variations in resistance of the plate from one production period to the next; some areas stand up much better than others.

For general line cans, electrolytic has gained much acceptance. War-time production restrictions, however, have been heaviest in these types of containers. War and resulting tin shortages probably have advanced electrotinning some years.

For many dry packs, external corrosion being the only hazard, 0.50-pound plate stands up well under favorable storage. There are indications even lighter coatings will be satisfactory for coffee, candies, shortening and others. Plate in the 0.25-pound class can be soldered. The 0.50-pound plate is priced in relationship to hot-dipped as to reflect savings in tin; if extended on this basis to coating weights lower than 0.50-pound, containers of such plate might be lowest cost metal cans for some low moisture content products.

The 400,000-ton capacity bonderizing lines will be confronted with severe competition when tin is available in normal quantities. Until then, in can-ends for some processed and many non-processed cans, bonderized plate is serving satisfactorily.

In some fields enameled ordinary black plate might compete with electrolytic; for ends of oil cans, bodies and ends of non-hermetic containers this plate was extensively used in prewar years, but was subject to some rusting in transit from mill to canmaker. Under-film rusting after enameling is another form of corrosion. Bonderizing minimizes rusting in transit, also under-film rusting. Increased quality warrants a differential over untreated black plate but if maintained at current levels bonderized will most certainly have a competitive factor to overcome with electrolytic.

Appliances

By R. L. HARTFORD
Associate Editor, STEEL

Production of electric irons for civilian consumers was started at the Westinghouse Electric & Mfg. Co. plant at Mansfield, O., last autumn, the first consumer durable goods to be made at the plant since 1942

NO INDUSTRY has been more severely affected by wartime production limitations than that devoted normally to the manufacture of domestic appliances. In some respects, with the possible exception of automobile building, the industry is the most important one to have been almost completely knocked out by governmental regulations curbing production. At the same time, however, it is the first of the major industries subject to reconversion, as witnessed by the fact that several companies were permitted in the last half of 1944 to reconvert their facilities to electric iron output.

Because of the completeness of this industry's conversion to war work, the job of reconverting it is bound to be a big one. There are several factors involved which complicate the job, not the least of which is the tremendous expansion in capacity of the industry's plant as a result of war work. Also, there are literally hundreds of companies not previously manufacturing household appliances which have signified their intention of entering the field after the war. There is also the fact that the industry was extremely progressive, with new models year after year, and constant new developments which brought forth either completely new products or refinements in older ones. The gap of at least three years and possibly four years since termination of production has probably brought with it a large number of new ideas, so that manufacturers cannot go back to the point where production ceased, but must reconvert to some new level.

Other serious problems must be met. Higher labor costs are inevitable, which means higher prices. This may require a whole new marketing procedure on some items. There are complete new fields to tackle which have not been explored, including the quick-freezer for home use, the electrostatic air cleaners, television and allied new radio developments.

Reconversion Problems

The reconversion problem divides itself roughly into two parts. First and most pressing is the physical reconversion of plants and equipment. Second, and no less important in the long pull, is the reconversion of more abstract things, such as the marketing problems involved, and switching of the main emphasis from production to economical operation and salability of products.

The most difficult factor, which runs through both these groups, is that of costs. The manufacturer of household appliances finds himself confronted with a higher labor rate and more expensive materials. He is faced with the likelihood that his selling prices on a refrigerator, for example, must be 20 to 30 per cent above his last models for the same amount of freezing capacity and the same convenience features.

For this reason, it is imperative that government price controls be eliminated as rapidly as possible. There certainly will be a period between war production and full peacetime production when manufacturing costs will be high, and in order to guarantee full employment, manufacturers must be free to set prices at levels which will enable them to weather this transition period.

Naturally, once this interim period has passed, the competitive situation arising from supply and demand will force prices to seek proper levels. However, there is no "proper" level now, because of the various extraordinary factors affecting supply and demand, and the fixing of price ceilings on past experience would probably result in price scales which either would be ruinous to manufacturers or would result in inferior products which the public would not buy.

Wages will not decline in the postwar period, and most appliance manufacturers are agreed, as manufacturers of consumer goods, that higher wages mean more purchasing power, and as a result, more demand for stoves and washing machines. However, there is an important factor in the labor rate picture which must not be overlooked. That is the productivity per worker, which

Home appliance industry, completely converted to war production, faces difficult task in resuming civilian output. Many new companies will enter field. Postwar costs, particularly labor, are expected to be higher

means the labor cost per unit product. In this category lies the success or failure of any manufacturer in the highly competitive field of household appliances. That there may be a solution to this problem in incentive wage systems is seen in the experience of one manufacturer of a complete line of household goods who has used incentive plans in four different plants, employing between 2500 and 9000 workers.

Most forward thinking executives realize the trend toward lower unit cost is a strong one. They believe the trend will continue, and that technological development can be used to offset increased per unit labor cost, with direct advantages both to management and to the worker. As a case in point, one executive recently cited the cost history of a small alternating current motor, which in 1910 was manufactured in a plant where the average wage rate was 26.5 cents per hour on a 54-hour week. In 1940 this motor was made by labor working for 80 cents per hour, 40 hours per week. The labor cost, however, was only 85 per cent of the 1910 figure, despite an increase of 200 per cent in hourly labor rates.

Trends Not Changed

These trends will not be changed by the war, but they may be slowed down. It is a reasonably safe assumption that there has been no increase in worker efficiency as a result of the war. That comes only because of competition and its accompanying technical developments. However, there has been a substantial increase in wage rates. Thus the manufacturer when reconverted will be forced to pay more money for labor which is no more efficient than before the war.

Insofar as the appliance industry is concerned, there will be jobs for all prewar workers and probably a lot more. One typical plant which before the war turned out refrigerator cabinets, ranges, washing machines, and smaller home appliances, reached its peak employment in July, 1941, when 5000 people were on its payroll. This dropped to 1500 during the lowest period in 1942 when the manufacture of civilian goods declined and stopped, and increased to 4400 in 1943 as the plant was converted to war work. Postwar plans for this plant call for an employment figure of 6000 within a reasonable time after unrestricted manufacture of civilian goods begins.

Unfortunately for the household appliance industry, few of the technological advances which have come as a result of the war can be applied to lower costs in postwar manufacture. Largely a problem of assembly of light components and surface finishing for sales appeal, the industry gains little from machining and tooling developments. There will be some ideas picked up from aircraft manufacture which can be used to good advantage, including multiple hole punching, welding techniques, and to some extent, all fabricating techniques involving light metals and plastics. Refrigerator makers can gain some ideas on lower costs from new developments in insulation, and here and there new finishing ideas have come along, particularly in protective undercoatings, which may reduce costs somewhat. All these things are important, of course, but they do not add up to a major change in technique. The real change in costs will not come until after the manufacturers once more get into production and begin to gain new experience. This brings us around once again to that all-important interim "settling down" period, and its probable effect on the industry's postwar outlook.

It is probably safe to say that on the average, postwar plant will be larger than present plant. There will undoubtedly have to be much rebuilding and revising, and in fact some experts are already indicating a gain of 170 per cent in private industrial construction for 1945 over 1944 levels as reconversion gets under way.

Although America's plant capacity has been tremendously expanded as a result of the war, the appliance industry itself has not been swollen to such a degree. It is true that there will be a much larger capacity than before the war, due to the fact that many more manufacturers will attempt to enter the field.

Early Postwar Items To Be Redesigned

One of the big questions concerns that of demand. That there is a lot of it is not questioned. However, the problem of satisfying it is not as simple as might be expected. Throwing anything on the market just to have something to sell is obviously not the answer, as has been proved by the bicycle trade. Although bicycles are very short, when rationing was removed in mid-1944, there was no rush to buy the available models.

Most appliance makers feel the same thing will be true of all the household appliances. They point out that the housewife has been "making the old one do" for several years, and if the new one is not what she has been hoping for, she'll wait until a later model appears with just the gadgets she wants on it.

This demand factor may have much to do with the reconversion timetable. The job of putting out a new washing machine is complicated considerably if that machine has to be a complete new job from stem to stern, and not just a 1942 model repainted and with a little aluminum and plastic trim added. Most companies are planning to do a thorough revamping job, and the timetable runs something like this: For obtaining material and rearranging factory, three months; for fabricating parts, one month; for initial assembly, one month —or five months after the paper work is done for the first new model to be built. Thereafter for about four or five months, production can increase to capacity. This, of course, supposing the sales and development work has been done right, and there are no changes in the model required after the first few have hit the markets.

This timetable will, of course, vary from plant to plant. For example, the radio industry will not require anything like nine months to reach full production, because it will use the same components in civilian radios that it used in military jobs. Thus, its parts lines are already in operation, and its plant is already in shape. It is merely in the final assembly that changes will have to be made.

In addition to the prewar items of heavy demand, including refrigerators, stoves, washing and ironing machines, hand irons and the like, the industry will be pushing along several new developments which found limited use just before the war. These lines include television, FM radio, electric dishwashers and garbage disposal units, electric clothes driers, automatic washing machines, home freezer storage units, air conditioners, electrostatic air cleaners and others. Then, too, there are some additional developments which are in the "not yet but soon" category, including high frequency home heating apparatus, and the induction range, which cooks food from the inside out and in a few seconds instead of minutes or hours.

Construction

One of the largest pieces of fabricated steel ever to be transported by rail, this bridge girder required three flat cars equipped with special couplings and support plates to distribute the weight. The girder is 154 feet long, weighs 97 tons. NEA photo

A CONSTRUCTION backlog of $10.5 billion awaits the relaxation of manpower and materials restrictions at the end of the war, and plans for new building projects are emerging steadily.

Numerically, residential units bulk largest in the postwar picture, although the heavier types of construction will outweigh homes in volume of materials and funds expended. Estimates of residential building range around one million units a year for the decade following victory. Each of these is expected to require more steel and other metals than the prewar home.

Heavy engineering construction will be the most important in dollar volume. F. W. Dodge Corp., fact-finding organization in the construction industry, has a list of contemplated or planned projects aggregating $6.8 billion. These include streets and highways, dams and reservoirs, sewage systems, electric light and power plants and airports.

A heavy demand for public and semi-public building construction also is indicated for schools and colleges, hospitals, churches and government buildings. Manufacturing and office buildings will swell the total.

The War Production Board, in preliminary estimates issued last month, placed 1945 construction at $4 billion provided Germany is defeated during the spring. This would be $160 million ahead of the 1944 volume. If V-E Day is delayed until later in the year, WPB estimates the 1945 total may be only $3.15 billion, or $690 million below the 1944 figure.

Comparisons tentatively figured by WPB follow:

If Germany falls: Public construction, $1860 million; private, $2090 million; military, $450 million; industrial, $725 million; housing, $775 million; all other, $2 billion.

If Germany does not fall: Public, $1680 million; private, $1470 million; military, $480 million; industrial, $595 million; housing, $525 million; all other, $1550 million.

Last year's construction was not quite half the 1943 total of $7.7 billion and less than one-third the 1942 peak activity of $13.4 billion. The decrease was due largely to the fact that the huge war plant building program was largely completed in 1942 and early 1943. The peak in war construction came in August, 1942, and continued at high level through the first half of 1943. During the past 18 months such construction has declined steadily.

The trend in war construction is illustrated by the following WPB index figures:

Total War Construction*

(Monthly Average, 1943 = 100)

	1940	1941	1942	1943	1944
Jan.	..	]	79	134	45
Feb.	..	|	86	130	39
March	..	|	108	131	36
April	..	45	125	122	36
May	..	|	145	118	36
June	..	]	168	110	35
July	]	]	193	100	31
Aug.	|	|	203	94	34
Sept.	|	|	201	78	31
Oct.	19	71	182	70	30
Nov.	|	|	171	60	†26
Dec.	]	]	145	53	†23

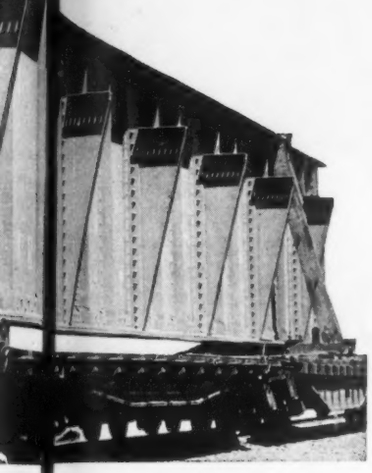
*Value-in-Place basis; government financed.
†Scheduled.

While a tremendous potential demand for construction awaits the end of the war, immediate translation of these potentials into actualities may be hindered by four bottlenecks: Government controls; materials supply problems; pricing problems; and manpower problems.

The slackening in building activity in recent months has caused many construction craftsmen to seek employment in other fields. Many have gone into the

Huge construction volume awaits relaxation of wartime controls on manpower and materials. Need seen for million residential units yearly. Structural steel fabricators wondering to what extent tremendous advance in wartime welding can be utilized in postwar economy. Engineers differ in opinions

By L. E. BROWNE
Associate Editor, STEEL



armed services. After victory, there may be a temporary shortage of skilled workers; however, manpower is not expected to be a delaying factor for more than a few months.

Construction revival, according to the F. W. Dodge Corp., will fall roughly in three phases. The first, or reconversion phase, will last three months after V-E Day. Deferred maintenance, repair, alteration and modernization will move ahead as fast as men and materials become available. Appreciable amounts of construction will be involved in reconverting war plants. Strong demand will exist for home construction, especially for owner occupancy. Heavy engineering construction, using principally noncritical materials and unskilled labor, should get an early start. The first phase also is likely to see the start of letting contracts for public building projects, particularly veterans' hospitals and local government buildings.

The second phase, according to the Dodge organization, will consist principally in a snowballing of contracts for new construction of the kinds that began in the first phase. Store modernization is likely to increase considerably. There is likely to be a large increase in contracts for new factory construction for peacetime industries. This phase is expected to extend beyond victory over Japan and beyond final removal of government controls.

The third phase will start after rent controls are lifted and after construction costs have become fairly stabilized, giving assurance to investors that rental projects can safely proceed. In this phase apartment building will increase greatly. If by that time office space released by demobilization of war agencies has been absorbed, new office building may appear in contract listings.

Despite much talk about new materials, designs and methods in the postwar period, most construction authorities believe changes will not be radical.

Welding, for example, has gained tremendously. To what extent will these gains be carried forward in the postwar era? Consensus is that welding will retain most of its gains in shop work, less in on location construction.

Structural steel fabricators differ in their views on the extent to which welding will be used. Typical of engineers' views are these:

Chief engineer of a southern shop: "Welding will find a development in products that are produced in quantity, but in structures that are not duplicated, the necessity for jigs will make it too expensive. The use of welding in structures would require much more shop floor space and thereby increase overhead expense."

Designer Favors Welding

A designing engineer for an eastern shop which has played a notable part in the ship program, landing craft especially:

"Welding allows the designer far greater latitude in obtaining a desired result than riveting. Structural frames which, when riveted, result in cumbersome, and often unsightly details, can be made with simple and neat connections when welded. Demand for rigid or continuous structures to save steel during the war will be continued in peacetime, as welding lends itself particularly to this type of structure."

Chief engineer for a western shop: "Fabricators, generally, should resist all possible welded design for mill buildings, office buildings, railway and highway bridges. Our plants are fully equipped with machinery and manpower for riveted work. We cannot economically do both welded and riveted structural work in the same shop at the same time."

These comments on welding are representative of engineering opinion. For many uses, notably in prefabrication, this method of joining will carry over. Large tonnages of cold-formed light gage steel have gone into war structures, hangars, barracks, storage buildings and others. This will also have a postwar influence, likely to stimulate demand for heavier sections rather than displace them. Light gages will be competitive with wood.

Wartime developments and practices, which have admittedly widened the field for most structural fabricators, have progressed far toward making the industry less tonnage-minded; in some instances this may have weakened proven experience involving costs and efficiency.

Two Outstanding Jobs Done

The structural fabricating industry has done two notable jobs, building the industrial war plant and contributing much to the ship program, notably the landing craft for which more than 100,000 tons of steel have been fabricated.

More than 1,000,000 tons of steel, including plates and sheets, were taken by fabricating shops last year. More than half was for bridges and buildings, for the most part directly or indirectly connected with the war effort.

In terms of tons, bookings and shipments are relatively light. Structural mills are also reflecting changes in fabricating demand. Approximately 3,320,000 tons of heavy shapes, three-inch and over, were rolled in 1944, slightly under the 3,349,377 tons the year before.

Another near-peak in light structurals was maintained, estimated at 1,226,000 tons. Total volume of shapes, in tons, was but slightly away from the 4,816,844 tons in 1943.

The uneven relationship between structural mill and fabricating shop tonnage continues to widen in wartime. Assuming around 4,800,000 tons of shapes, heavy and light, were rolled, approximately 1,000,000 tons were handled in fabricating shops with distribution of the balance uncertain, but centered among jobbers, shipyards, railroads, heavy equipment and other numerous smaller consumers.

Heavy structural mills operated around 50 per cent potential capacity, but lighter units probably somewhat more. Given enough steel, structural rolling mills could meet any strain placed on them beyond anything yet experienced.

Disposition of excess machine tools at end of war is one of gravest problems facing builders. Government will own approximately 500,000 tools, of which 100,000 will be retained for security purposes, leaving 400,000 surplus

Machine Tools

By GUY HUBBARD
Machine Tool Editor, STEEL

UNPREDICTABILITY of the demands of war is nowhere better illustrated than by comparison of the projected and actual charts mapping the course of the machine tool industry during 1944. The course which was charted for that industry at the beginning of the year, and the course which subsequent fortunes of war forced the industry to follow, departed so widely from each other that it was only through independent and skillful navigation practiced by the "pilots" of the machine tool building companies themselves, that "stranding" of critically important parts of the war production program have been avoided.

At the time when this article is being written, there is much speculation and no small amount of argument as to where responsibility lies for shortages which have developed in shells, heavy guns, tanks and certain other items, especially on the western front. Such speculation and such arguments contribute less than nothing to the big job of the hour—which is to overcome those shortages before they result in needless loss of life among the American and allied forces.

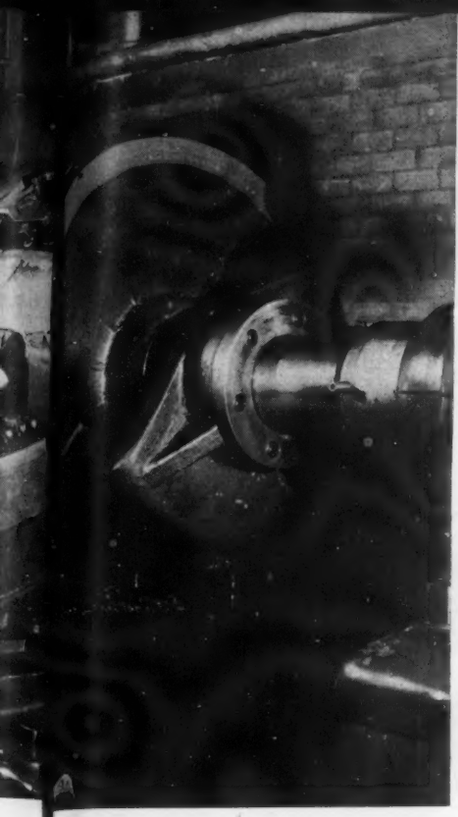
However, we are justified in calling attention at this point to the fact that in these speculations and arguments there has not been that tendency—all too prevalent back in the days of our so-called "defense program" and subsequent even to Pearl Harbor—to attempt to hang responsibility for nondelivery or slow delivery of war material on the machine tool industry. In those earlier days no branch of American industry was carrying any heavier load and getting any less credit for doing a truly remarkable job. Today the machine tool industry continues to do the same remarkable job and at least it is not being blamed thoughtlessly for conditions for which it in no way is to blame. As a matter of fact, it occasionally comes in for a bit of well-earned praise.

Without going into great detail as to the course which was charted for the machine tool industry at the beginning of the year 1944, it is in order to recall the following circumstances. After reviewing the situation thoughtfully, and peering behind the veils of the next 12 months as far as was humanly possible, competent authorities of the Army, the Navy, the Air Corps, the War Production Board, and of Lend-Lease, pooled their findings in the prognostication that $330,000,000 worth of new machine tools would be required in 1944.

While this was a tremendous figure compared to any normal year, it did represent considerably less than 50 per cent of the prodigious annual peak capacity which previously had been achieved by the industry in its efforts to meet wartime machine tool demands. The implication was obvious. In order to occupy their greatly expanded facilities and working forces to the continued benefit of the war program, it would be necessary for many machine tool builders to switch their facilities to other types of war work, to a greater or lesser degree depending on the extent to which machine tool cutbacks affected them.

With cancellations averaging $15,000,000 per month even in 1943, machine tool builders had every reason to have faith in the 1944 course charted for them by Washington authorities. Therefore, widespread contracts and subcontracts were undertaken on a wide variety of direct war work to which the equipment and the skill of the industry seemed adaptable. As a matter of fact, many projects were undertaken which required many new facilities—special tooling in particular—as well as augmented working forces, including hundreds of new women workers.

Great ingenuity was shown and still is being shown by machine builders in the quantity production of such widely diversified items as torpedoes; tank parts and unit assemblies; aircraft engine parts; diesel engine frames; with emphasis more recently on artillery components and artillery ammunition, especially of the larger calibers. It should be noted in passing that all this was done in the face of acute manpower and womanpower difficulties. Those difficulties



Close work is done on this milling machine in the Chrysler tank arsenal. It was designed for work on the turret of the cannon on tanks

were due primarily to two things: First, ill advised and premature publicity from certain Washington bureaus as early as 1943 to the effect that "the war tooling program is now finished;" and second, inroads of the draft into the already dwindling supply of highly skilled men available to the machine tool builders. The second factor has affected a number of vital industries, including foundries. Unquestionably it is, in part at least, responsible for the critical situations which, at the time this report is written, have so suddenly terminated—or at least shelved—active development of various and previously approved postwar projects throughout the metalworking industries.

Until about the time of the spring meeting of the National Machine Tool Builders' Association, in Cleveland early in May of 1944, the overall prognostications of the Washington authorities had not proved too far out of line. By that time great strides had been made by the industry toward retooling for direct war work to take up the slack—machine tool orders having in the meantime fallen to as low as $29,000,000 per month.

Then, while that meeting was underway, something happened which now can be recognized as having been a premonition of the great European invasion—at that time still about a month away. A representative of the Army Ordnance Department appeared unexpectedly at that meeting with an urgent appeal for shell turning equipment and equipment for fuse production. While this affected lathe, turret lathe and automatic manufacturers primarily, it had repercussions throughout the industry.

The result was that many machine tool plants which already had converted to other work—much of which still was vital to the war effort, therefore, not to be dropped—had to resume machine tool building in a big way. That was a bigger problem than the original expansion had been. A machine tool building program is not something which can be slipped into like a ready-made suit. The whole thing has to be tailored to fit, and there was little time for tailoring those surprise programs. Strained though they were after having coped with emergencies which long antedated our entrance into the war, machine tool men, knowing that so much depended upon them, threw everything that they had into this effort. Again they are meeting the situation.

What that situation is, can be expressed in a few words by the statement that from a monthly low of $29,000,000 in the first part of 1944, machine tool firm orders rose rapidly to a monthly high point of $60,000,000. Instead of the predicted $330,000,000 volume of business, the actual figure recorded in the machine tool history of 1944 will be approximately $510,000,000. Bear in mind that this figure represents machine tools only. None of the millions of other war production turned out by machine tool plants in 1944 are included in this amazing total.

Prophets Silent This Year

In view of how wrong (though well intentioned) the business prophets of a year ago proved to be as far as the machine tool demands were concerned, their failure to follow through with many 1945 prophecies is quite understandable. However, with the war in Europe settling down to a gigantic slugging match mainly on the ground, demands for guns, ammunition and heavy vehicles continue to mount. It looks as though heavy demands for machine tools will carry over well into 1945.

Of other things which happened in and to the machine tool industry during 1944, history will accord great importance to the joint conference between the American production machine tool builders and the master mechanics and plant engineers of the General Motors Corp. During this conference, held in Detroit April 27 and 28, 1944, builders and users of machine tools for the first time in history got together in a big way to determine definitely what needs to be done to make American machine tools—already the best in the world—even better and more efficient and easier to service and to operate than they are today.

The discussion was extremely frank but also was in the spirit of good sportsmanship on the part of all parties to it. It was a big help to the war effort in that many difficulties immediately were ironed out. It will be of inestimable value to postwar industry in that many hitherto unrecognized shortcomings already have been "exorcized" from postwar designs now "on the boards," and in addition many an entirely new design idea was born of that meeting-of-minds.

The bugaboo of the excess machine tools which will exist at the war's end still haunts the industry. However, when it is considered in the light of facts rather than fears—as it is being considered now by leaders of the industry—it doesn't appear to be quite as menacing as it did at first sight. General opinion is that nothing can be gained by artificially freezing this surplus, by sinking it in the depths of the ocean or by letting foreign countries skim off the best of it—leaving us with the worst.

According to the best minds in the industry, the war-built standard tools immediately should be used at the end of the war to displace once and for all the thousands of aged tools with which American metalworking plants will struggle along to an extent that few people realize. Having dislodged the "junkers," the war-built tools will serve well to keep American industry running more efficiently than otherwise would be the case, until they in turn are replaced by the far superior machine tools which will become available within a year or two after the war's end, if not sooner.

The fact remains that when the war ends the government alone will own about 500,000 machine tools. Of these probably about 100,000 will be retained for security purposes. The other 400,000 must be disposed of somehow. A lot will depend on how—and how well—that great project is handled. The industry was greatly encouraged while Will Clayton was in the saddle, and his departure has been much regretted. However, a number of other capable men both in the government and in the industry are giving careful thought to this problem. No doubt a workable plan will be ready by the time the day of reckoning comes.

All that, however, is not diverting machine tool builders from the biggest task of all. It is that of continuing at top speed to furnish the tools to finish a job which a year ago many of them believed—and all of them hoped—would be finished by now as far as its European phases are concerned. In this production race, hours cost lives. Machine tool builders are outdoing themselves to save lives.

Machinery and

Giant riveters used in the Chrysler tank arsenal weigh more than 4 tons, have a squeezing pressure of more than 100,000 pounds per square inch. The riveters are suspended on overhead cranes and move along the assembly line on trolleys

THE BLANKET term "heavy equipment" is one which long has been employed—sometimes rather thoughtlessly—to cover several highly important varieties of industrial machinery. Little or no general publicity has been given to metalworking heavy equipment. It has been overshadowed by other types of machinery—machine tools in particular. It is high time that due recognition be given to the vital and basic part which this machinery has played and is playing in our war production program. The fact that at a time when machine tool production, in a number of its phases, has passed its peak, several types of heavy equipment still continue in the "critical" category, tells the story of its importance, in few words.

Exactly what constitute the boundaries around heavy equipment is a moot question. Those boundaries never have been clearly defined, except to the extent that certain machinery is recognized as falling within them, without a question. Whatever the extent of those boundaries may be, they certainly do not include big machine tools, public opinion to the contrary notwithstanding. Machine tools are defined by The National Machine Tool Builders' Association: "Power-driven metalworking machines, not portable by hand, which remove metal in the form of chips."

Eliminates Cutting Tools

That definition, therefore, excludes steam, air and drop hammers, and other forging machinery, both hot and cold; shears and press brakes; metal rolling machinery; punching, stamping, drawing; bending and forming presses; extrusion presses; piercing presses; swaging machines; upsetters and heading machines; large riveting machines; wire, rod, tube and strip forming machines; and similar equipment. For purposes of this rather brief review, let us give consideration to the foregoing as typical of heavy equipment in the metalworking field. In other words, it is machinery which works metal by "shearing, bending, kneading and otherwise pushing it around," rather than cutting it away in the form of chips, as machine tools do. In these days when conservation of metal is so important, there are interesting implications in that last statement.

When this war began, builders of this heavy machinery had been through a number of terribly lean years. It is a wonder that they survived. It was a most fortunate circumstance for this country that they did survive, because, had it not been for them, we might well have lost the war almost as soon as it began. As it was, the limited capacity which we did have—for production of big power hammers, for example—suddenly was recognized by the War Production Board as one of the most serious bottlenecks in the war production program.

By tremendous efforts on the part of a mere handful of companies in the highly specialized business of building hammers and other heavy forging equipment, the immediate crisis was met better than anyone had any right to expect. However, the pressure on these companies never has let up. Revival and intensification of shell production and production of heavy vehicles in 1944 has put still further pressure on this industry.

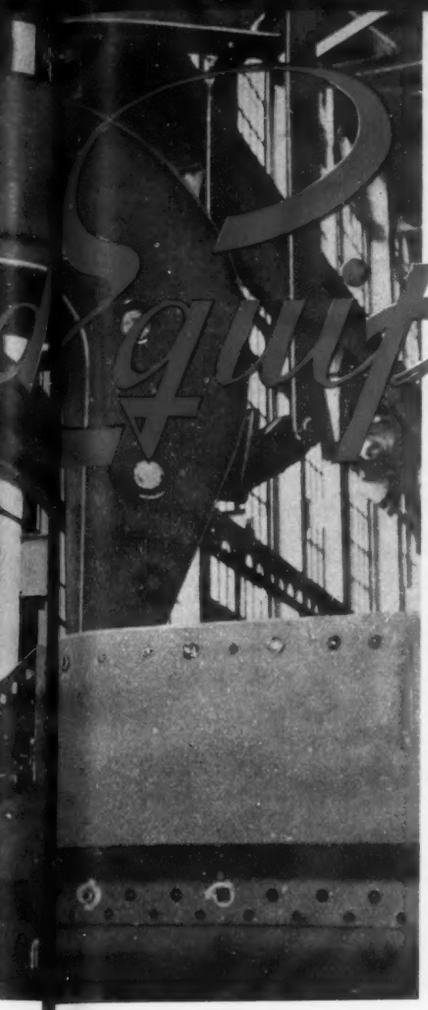
While on the subject of steam hammers, it should be mentioned that, during the past year especially, efforts to put this industry on something approaching a mass production basis have borne full fruit. Hammer building used to be a one-at-a-time proposition carried on by all around craftsmen working with rather inadequate equipment in some cases. Today those shops have the latest types of machine tools and handling equipment, unit manufacture and assembly is being practiced, and the final assembly and testing is comparable to that in a modern machine tool plant—except for the great size and weight of the finished product.

Though major emphasis has been on getting out the machines, design refinements have not been neglected. For example, analytical studies of the working of metal in dies have given rise to certain modifications of the cycle of the hammer as a steam engine which make it a better forging instrument.

Steam and air hammers are thought of primarily as handling solid material, while punch presses are thought of as handling sheets. That no longer is entirely true. The war has given impetus to repetitive impact forming of sheet material in dies under hammers. Large batteries of hammers so equipped for sheet metal forming have appeared in leading aircraft plants and have contributed materially to the speeding up of fuselage production, replacing slow hand forming in many cases.

In forging machinery generally, the tendency continues to produce work closer and closer to finished dimensions. The war has stimulated this both through more power, greater accuracy and better control in the machines and through new techniques in die design. This extends to light metals such as magnesium alloys. Heated dies are becoming important factors with magnesium.

Builders of automatic chucking ma-



Equipment

By GUY HUBBARD
Machine Tool Editor, STEEL

Some heavy metalworking equipment continues in "critical" category. Many long-standing traditions in design, construction and use have been brushed aside by war developments

chines see postwar possibilities in these accurate hot forgings. Some of them already are planning tooling for their "chuckers" in which roughing cuts will practically be eliminated.

When it comes to elimination of machining, cold forging and cold heading machines have gone even further. While automatic production of shaved head, rolled thread bolts and screws on these machines now is a comparatively old story, the quality of the work lately has reached new heights and speeds have been greatly increased. Recent developments in dies also have made possible the production of many parts other than screws on these machines. It is significant that within the past few months restrictions against the use of upset head, rolled thread screws have been lifted in connection with a number of vital aircraft engine applications.

Shears and press brakes are coming into their own as never before because of the great amount of plate work involved in the war production program. These machines are being tied in more closely than ever with fabrication by welding.

With the recent advent of larger, heavier and more powerful press brakes—some of truly amazing size—and ingenious developments in bending, forming and piercing dies for the brakes, more and more of the elements of welded structures today are bent and formed preliminary to welding. This eliminates a lot of unnecessary welding, does away with unsightly sharp corners, adds strength and generally contributes to the cause of welded fabrication. That is true particularly in the field of machinery frames, marine gear cases and other structures involving extremely heavy plate. Extremely clean and accurate gang punching of heavy plate likewise is being carried out in heavy duty, punch and die-equipped brakes. One of the outstanding contributions of these machines has been in furthering mass production of the now famous LST (Tank landing ships).

While speaking of the forming and fabrication of plate work, it is in order to call attention to the facility with which heavy punching and riveting is being done through use of apparatus such as that illustrated herewith. Through coordination of power handling equipment with the portable, unit powered machine, this massive and powerful piece of equipment is given maneuverability equal to that of a small hand-held tool.

Brings Machine to Work

This technique of "bringing the machine to the work instead of bringing the work to the machine," is one of the significant trends in heavy metalworking practice—particularly that on extremely large and heavy structures. An increasing number of machining operations are being handled in the same way. This may foreshadow the advent of quite extensive new lines of "work-mounted" machines in the postwar era.

In connection with the late 1944 drive to increase ammunition production, machine tools have been getting a lot of publicity, forging machinery some publicity, but blanking, drawing and forming presses have had little or none. However, they are playing roles of prime importance both in the production of shells and of cartridge cases.

Press and die people have had some very tough problems put up to them by the war—one of which was the drawing of steel shell cases. While that program seems to have been laid on the shelf as a result of easing of brass, the fact remains that the press and the die people licked the problem. In doing so equipment was built which is doing a faster and better job of blanking, drawing and finishing brass cases.

Some of the unsung wartime achievements of the punch press and die technicians are ones which most of us see every day but don't recognize. How, for instance, have the untold millions of rationing tokens been produced?

They are the products of stamping and embossing presses—a great many of them, though not all of them, being made at prodigious speed by means of unique machines wherein multiple punches and dies literally "chase after the stock" as wide strips feed through steadily (not intermittently). Action in a way can be compared to that of a flying shear. Running at 10,000 strokes per minute and employing multiple dies, these superspeed presses readily turn out 10,000 parts per minute.

And so it is, that as a result of the war many longstanding traditions in design, construction and use of heavy equipment have been brushed aside. Time and material losses are being eliminated, operator fatigue is being reduced, and better work is being turned out faster than ever would have been possible had the old traditions remained. Just now these developments are dedicated to the winning of the war. Later on they will help America to "hold her own" in a highly competitive industrial world.

Petroleum industry, taxed to meet war demands, faces some difficult reconversion problems. Further expansion of refining capacity possible

By J. C. SULLIVAN
Assistant Editor, STEEL

AS VITAL cogs in the nation's war machine, the oil and gas industries have been concentrating on production for military use. Naturally, this has resulted in developments which will present troublesome problems after the war. Reconversion as a whole, however, will not provide many headaches in these industries in their war-back-to-peace program, which necessarily will be deferred until victory is won.

Two major questions which only time can answer and upon which hinge to a large measure the industry's postwar plans concern aviation gasoline and synthetic rubber. In the first place, how much synthetic rubber will be used after the war? Will it be necessary for the oil companies to continue producing butylene, butadiene and styrene in large quantities, or can the petroleum used for these products be diverted once again to motor fuel?

There has been a considerable amount of thinking on this subject, and current thought seems to be that in using petroleum, we are consuming a non-replaceable raw material, whereas these products can be just as efficiently made from alcohol, which is a replaceable product made from molasses or grain. It is possible in view of this that the synthetic rubber load will be taken off the oil companies after the war.

100-Octane Fuel Market

In the second place, will automobiles be designed to use 100-octane fuel, and how many postwar planes will use this fuel? The refineries now making 100-octane fuel were partly constructed for the purpose, partly converted from the lower 80 to 86 octane fuel used in motor cars. About 80 per cent of the existing capacity can be used immediately after the war to take care of expected high demand for motor fuel, although this will in part be dependent on the speed of reconversion of the auto industry and the number of new cars which are placed in the hands of the public.

The War Production Board has allotted raw materials for the various branches of the petroleum industry for the first quarter of 1945 practically equal to estimated requirements. This estimate includes an increase over the last quarter in proportion to the expected increase in petroleum operations needed to meet the demands of war and essential civilian use.

Expediting of machinery and critical components for manufacturers is the most pressing need at this time. Greatest source of difficulty arises from the steady increase in the number of rotary drilling rigs. The unprecedented number of rigs in use and the anticipated further increase will create growing problems in obtaining supplies. There is also an abnormal demand for repair parts and replacements.

The manufacturing problem will be further complicated in 1945 by the foreign petroleum programs, which are expanding.

Tool joint deliveries are increasing although not yet in proportion to the increased demand. Production is steadily advancing as new machinery arrives and other facilities are completed which are part of an expansion program started several months ago by three of the leading manufacturers.

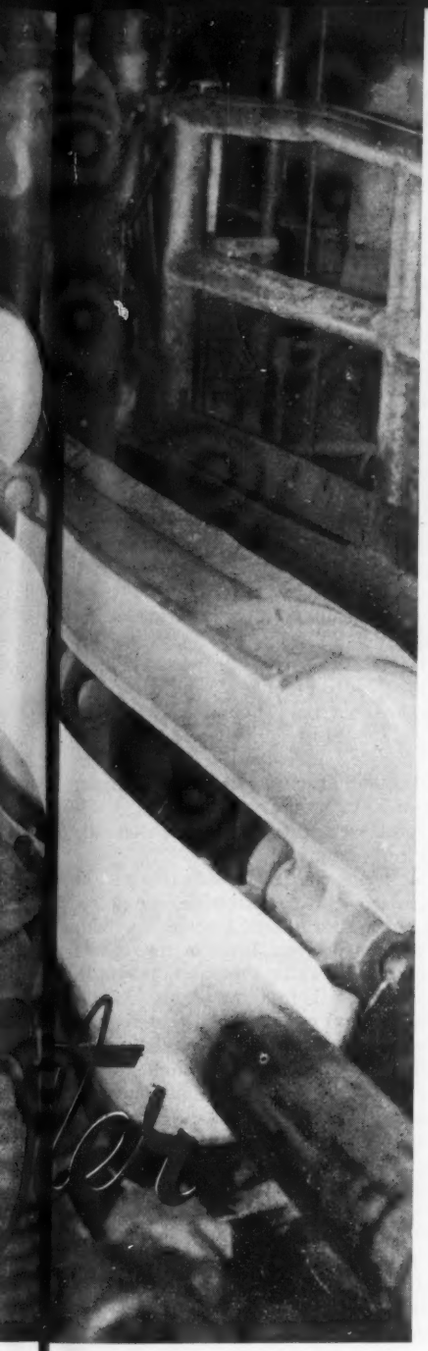
The drill-pipe supply situation will improve with the increase of tool joints. There is more drill pipe being produced than is being worn out and the situation will ease considerably when the rate of starting new rigs begins to slow up. Rock bits are becoming extremely critical again.

Tubular goods may become a serious problem in the first and second quarters with the increasing military demand and the augmented domestic and foreign petroleum requirements.

Production of butadiene from petroleum, hardly more than an experimental operation when the Japanese took over the bulk of the nation's natural-rubber sources, is now the major factor in synthetic-rubber operations, accounting for more rubber than was consumed yearly in this country during the late thirties. Through the manufacture of toluene, the petroleum industry has become a direct factor in warfare. The output of one refinery is credited with supplying the toluene for explosives used in every second bomb dropped on the enemy since Pearl Harbor.

Current domestic crude-oil production of 571,000 barrels weekly is 13.7 per cent greater than at the time the United States entered the war. The percentage growth in natural gasoline and condensate has been even more impressive. Refineries which operated at 86 per cent of capacity in late 1941 are now at 97 to 98 per cent. Flow of crude to stills in the comparable period have been increased more than 700,000 barrels daily, or 18 per cent.

These supply data should be considered along with the figures covering drilling operations. In 1941 up to Dec. 6, 29,376 tests had been drilled in this country and 30,157 in the corresponding per-



First piercing machine forms an opening through a steel billet at the Lorain, O., works of National Tube Co. The billet will be shaped into pipe

iod of 1940. In contrast, under governmental regulations only 39,166 tests were drilled in the like two year period of 1944 and 1943—a 35 per cent decrease under the two previous years.

Production of aviation gasoline, which at the start of the war was less than one per cent of the refinery yield, is now around 12 per cent and will be increased early this year to 15 per cent. If the petroleum production rate is sustained at about 5 million barrels daily, the anticipated output of military aviation fuel would be about 650,000 barrels a day.

Military demands for all types of gasoline increased from about 150,000 barrels daily in 1941 to more than 800,000 barrels daily in 1944—a jump of 433 per cent. In addition, military demands for other petroleum products bring the total military petroleum requirements that must be supplied from the United States to 1,600,000 barrels daily. Since 1941 domestic crude-oil production and refinery runs have been increased more than 20 per cent—about 900,000 barrels a day—to slightly more than 4,700,000 barrels daily.

Crude oil production must be maintained throughout 1945 at the present rate of 4,700,000 barrels a day regardless of when Germany falls, Petroleum Administrator Ickes states. This year a minimum of 27,000 new wells must be drilled to meet anticipated requirements. Included will be 5000 exploratory or wildcat wells and 22,000 development wells in known oil, gas and condensate fields.

It is conceivable that the gasoline shortage now existing will continue for some time after the end of the European war. In that case, there might even be further expansion of refining capacity. Military authorities have indicated that need for gasoline and oil in the war against Japan will probably be as great as in the European war, because of the longer distances involved and the greater transport problems. Therefore, it seems that the industry will not be in any position to talk about postwar problems at the end of the European war. On the other hand, there is bound to be some reaction on the home front if a partial reconversion takes place after V-E Day.

War-Stimulated Expansion

The story of the petroleum industry during the war has been one of expansion from the ground up. The increase in well drillings in order to boost petroleum extraction has been so large that one of the industry's postwar projects undoubtedly will be to retire from active service many wells now producing.

One war project which may prove a valuable aid to the ultimate consumer is the network of pipelines, headed by the Big Inch and Little Inch, which were built to speed petroleum transportation across country. The savings in cost here may be large enough to offset the increased cost of labor and materials at the wells and refineries, as well as at the gasoline pump.

It is apparent that the pattern for 1945 in the oil and gas industries will parallel the pattern for 1944. There will be little if any change in products or demand during the coming year, always excluding the possibility of a German and Japanese collapse, which now appears remote.

Assuming that the pattern remains unchanged, indications are that the petroleum and gas industries will provide excellent markets for tubular goods throughout 1945. Drilling activity will continue at high levels, and, while there may not be any major pipeline projects launched, there will be substantial line pipe requirements insofar as feeder lines are concerned. The refinery tonnage, which has meant considerable to the tube mills in the war years, will be substantially less, because the major part of that program has been concluded.

All major oil companies, recognizing the need for increased sales and service facilities after the war, have on paper ambitious plans for increasing the number of retail outlets, and rebuilding and enlarging present outlets. This program possibly will get underway before end of the Japanese war, regardless of the oil and gasoline distribution picture.

Petroleum industry officials estimate that by 1950 demand will reach an all-time peak of nearly 1.9 billion barrels of oil annually, necessitating a stupendous postwar task in retooling facilities, replenishing reserves and rehabilitating properties in all of the branches of the industry.

This postwar demand estimate is based on the following projected increase in requirements:

A total of 34 million automobiles and greatly expanded commercial and private flying are seen as the chief factors in boosting the gasoline demand forecast to 860 million barrels annually.

Home heating units are expected to rise to 3,600,000 or more, stimulating demand for distillate fuel oil to unprecedented peaks.

Diesel engines are assured more important position in industrial and commercial services.

Specialties, such as synthetic rubber, chemicals, and plastic raw materials are expected to continue to absorb increasing quantities of petroleum liquids and gases in the postwar period.

Considerable steel will find its way into public utility channels in 1945. In a report on estimated new construction activity in the United States, 1943-1945, the War Production Board estimates that in 1945 $80 million will be expended on water and sewer facilities in event full scale war continues in Europe and in the Pacific through the year. Should Germany be defeated in the spring of 1945, however, expenditures for such facilities are expected to rise to $100 million.

In 1943 expenditures for water and sewer facilities were estimated at $95 million, while in 1944 expenditures amounted to $79 million.

WINDOWS of WASHINGTON

Numerous pressing problems to confront the 79th Congress. Foreign relations to demand major attention but many domestic issues loom prominently on the legislative calendar. Course of action awaits enunciation of administration's program

FOR A NUMBER of reasons the 79th Congress, due to assemble Jan. 3, promises to be one of the most momentous in our history.

First, it is slated to find the answers to three pressing domestic questions: 1—To what extent should the Social Security act be amplified to cover a larger area of the public at large? 2—To what extent should Congress place floors under wages, and otherwise dictate or influence wage policies? 3—To what extent should federal expenditures be authorized for the purpose of bolstering the future economy?

Second, the 79th Congress will be chiefly preoccupied with foreign relations and foreign policy matters; the full scope of its deliberations under this heading still to be revealed.

Third, the 79th Congress will continue surveillance of the war effort and will be prepared to jump in any time to prod the program should any weak spots develop, as well as to enact any new legislation which new turns in the war may require.

Fourth, it will have problems of the reconversion period very much in mind. Although the 78th Congress created the main framework for guiding and controlling the reconversion process, it already is indicated that the principal reconversion laws, such as the G. I. Bill of Rights, the War Mobilization and Reconversion act, the Surplus War Property act and the Contract Settlement act will be revised to some extent.

For example, many business and other groups have complained that provisions of the Surplus War Property act are unfair to them, and changes are widely urged.

The outlook as to just what schedule the new Congress will follow will be much clearer after the President delivers his state of the union and budget messages. These should set forth the administration's program for what increasingly is being termed the "Fourth New Deal." They are awaited with unusual interest, particularly because the normally close contact between the President and congressional leaders has suffered a lapse since the November elections.

Congress, of course, will give serious consideration to whatever proposals the President advances. It may be said, however, that the 79th Congress is not likely to be a rubber stamp for the administration. It is true the administration added to its prestige in the November elections, and that some of the anti-administration figures have been eliminated, for example, from the roster of the important House Rules Committee.

Congress Acts Despite Elections

The election results did not deter both houses from again freezing the old age payroll tax rates for another two years over administration protests, did not prevent elimination of the President's cherished St. Lawrence river waterway project, abolition of the huge Jackson Hole national monument in Wyoming which was created in 1943 by executive order, did not keep the House from knocking out an appropriation needed for financing special reconversion census studies requested by the President, and did not hold the Senate from conducting embarrassing examinations of the Presidential nominees for key posts in the State Department and the Surplus War Property board.

This attitude of independence is expected to continue over into the 79th Congress. At the same time, there seems little reason to fear the development of any real hostility between the Congress and the administration. Cleavages that will occur, it is expected, will be related only to definite issues.

Agitation of the highly complicated subject of the social security system is expected to start immediately after the Federal Security Agency completes a report on which it has been working for months at the request of the Senate Committee on Education and Labor and the House Labor Committee. This report, due about the middle of January, is expected to recommend adoption of the main features of the Wagner-Murray-Dingell bill which is slated for reintroduction at about the same time.

The chief criticism of the 10-year old social security system, in a nutshell, is that it offers too feeble a defense against unemployment that looms ahead at some time in the future. The new Congress will be asked to extend its coverage to some 3,000,000 employes of small firms, some 6,000,000 government and maritime workers, and to millions of domestic and farm workers.

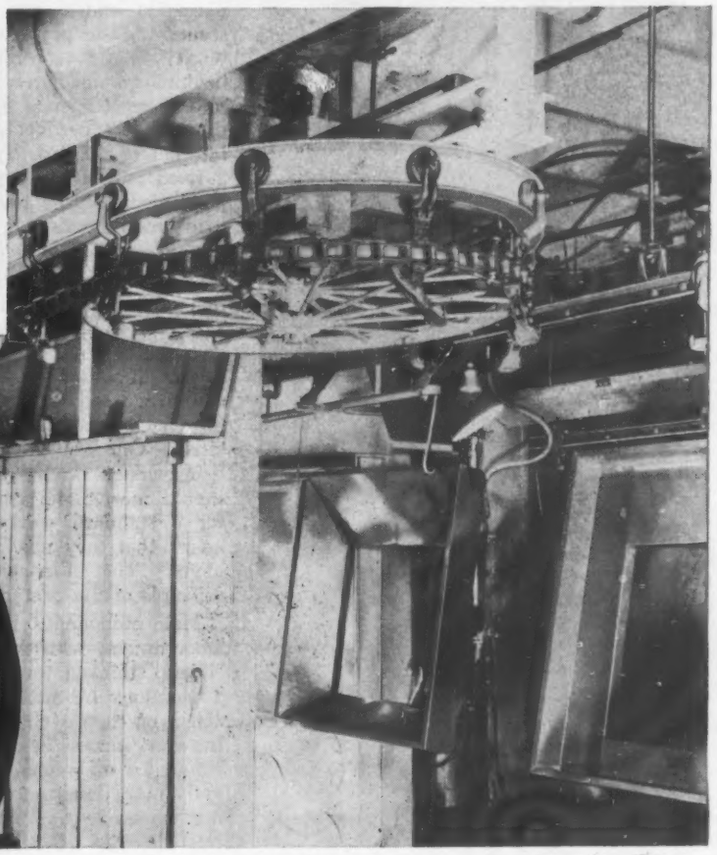
It will be asked to replace the present state setup with a nationwide unemployment compensation system which would: 1—establish uniform benefits throughout the nation; 2—raise the rates generally, with differentials to allow higher benefits to unemployed workers who have earned above-normal pay during previous employment; 3—extend the benefit period to at least 26 weeks; 4—eliminate the provision prohibiting payment of benefits to workers who are sick and unable to work; 5—revise the experience rating requirements and remove certain disqualifications such as the one forcing an unemployed person to accept any "suitable job."

Particular emphasis will be laid in the Federal Security Agency report on the desirability of creating new types of in-

Henry Morgenthau Jr., Secretary of the Treasury, standing at extreme left, appears before the House Ways and Means Committee, where all tax legislation originates. NEA photo

AMERICAN MONORAIL with Infra-Red Ovens CUTS BAKING TIME 70%

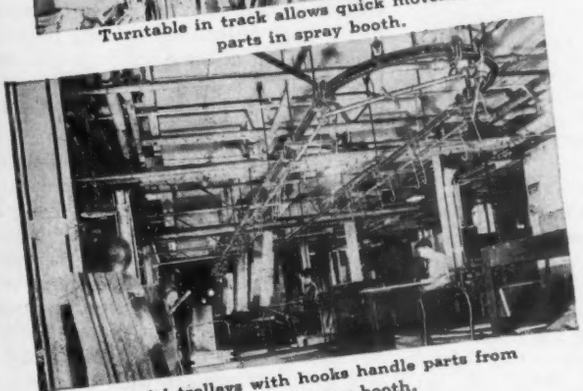
Storage bank on tracks assures supply of parts to sprayer.



Pusher feeds sprayed parts through oven on monorail to wrapper.

$1925. SYSTEM CARRIES PARTS FROM WELDERS THROUGH STORAGE, SPRAY AND OVENS TO WRAPPER

Turntable in track allows quick movement of parts in spray booth.



Special trolleys with hooks handle parts from welders to spray booth.

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REP. JOSEPH W. MARTIN JR.
Minority leader in the House of Representatives

surance to cover workers both temporarily or permanently disabled. Stress will be laid on the need for further legislation—possible overhauling of the G. I. Bill of Rights—to safeguard the position of returning soldiers and sailors under social security. The Wagner-Murray-Dingell bill called for $12 a week unemployment compensation for all former members of the armed services, plus $6 for each dependent up to $30 a week; It is expected these rates will be increased in the recommendations to be made to the new Congress.

A liberalization of the present old-age and survivors' provisions of the present system will be requested. Most proponents for higher rates under these heads want Congress to approach their ideal as nearly as practicable, which is a level of rates "sufficient to enable every aged person, and every survivor, to maintain about the same standard of living to which he or she has been accustomed." The outlook for an increase in these rates is considered good. The question is—how much?

Other 1943 requests to be revived include maternity benefits, a federal system of medical and hospitalization benefits, federal aid to states to help them meet the increased security burden. Another recommendation will urge revamping of the United States Employment Service, with offices assigned to natural geographical and economic areas without respect to the boundaries of the individual states.

Illustrating the trend in demands for higher and still higher security benefits is the one that the railroads be taxed at higher rates. The railroads now are taxed 3 per cent for unemployment compensation and 3 per cent for old-age security. The proposal is that they be taxed 5¾ per cent for old-age security beginning immediately and that this rate be increased later to 6 per cent, and ultimately 6¼ per cent. Thus the total bite out of railroad payrolls would be at a fixed rate of 9¼ per cent. This proposal again will be advanced by the railroad brotherhoods.

In its closing days the 78th Congress was confronted with the Pepper resolution setting a 65-cent floor under wages. The 79th Congress will have occasion to do considerable thinking about wage floors. It will be presented with a demand for two congressional wage control expressions that would have far-reaching effect. One would endorse the principle that workers in the reconversion period should receive the same take-home pay for a standard work-week, say of 40 hours, that they now receive for longer hours. The other would endorse the principle of the guaranteed annual wage.

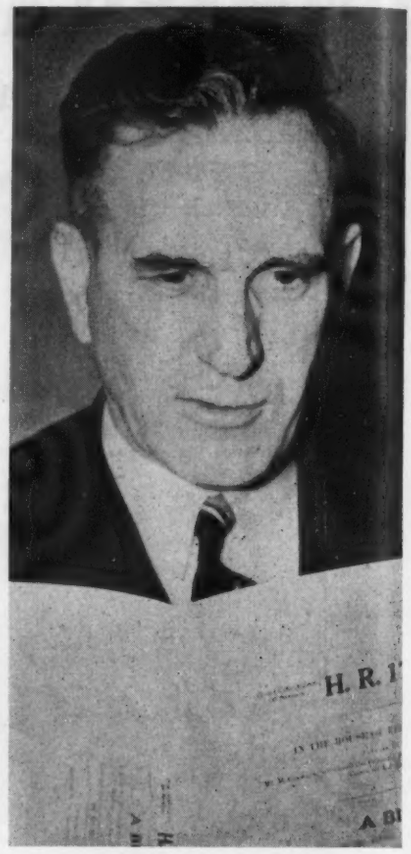
Main proponents of these ideas are the labor unions, with the backing of many "liberal" thinkers throughout the country. The unions are anxious to get favorable action on them well ahead of the end of the war; success in winning these points would be of tremendous help to them in holding their unions together following wholesale termination of war contracts.

Favor Annual Wage

Incidentally, showing the trend, Senator Walter F. George (Dem., Ga.) and Senator James E. Murray (Dem., Mont.), as well as numerous other congressmen, already have gone on record as favoring congressional approval of the guaranteed annual wage principle. President Roosevelt and administration leaders also favor the proposal.

And, as this is written, the Office of Economic Stabilization has not yet acted on the recent National War Labor Board proposals for higher wages in the steel industry. Nor has any decision yet been made by the President with respect to revising the Little Steel formula. It is entirely possible that this whole controversial matter may find its way into the new Congress.

The question as to future policies of bolstering the economy by federal expenditures and by federal policies will come up in various ways. On the heels of the 78th Congress' favorable action on a postwar program of $500,000,000 worth of rivers and harbors improvements, on a $1,000,000,000 postwar flood control program, and a $3,173,250,000 postwar highway program, no time will be lost in bringing up still another big program in the 79th Congress. This is the federal housing program—and nobody yet has any idea as to how large it will be when finally formulated.



REP. JOHN W. McCORMACK
Majority leader in the House of Representatives

Members of Congress have sensed a tremendous interest in the nation's housing needs and a large part of their correspondence for many months past has centered on this subject. The Taft subcommittee of the Senate Special Committee on Postwar Economic Policy and Planning has arranged to conduct a full-dress investigation of the housing problem starting Jan. 8. At these hearings anyone interested in housing will have a chance to have his say. What makes these hearings especially significant is the fact that sitting with the Taft subcommittee will be three members each from the two other Senate committees chiefly interested, the Banking and Currency and Education and Labor Committees. There is every reason to expect that a huge federal-aid housing program will come out of these hearings and that, backed by the three participating committees, it will for the most part receive Senate approval.

Revision of the War Mobilization and Reconversion act will be proposed so as to include a housing program among its authorizations, also to authorize federal financing of postwar public works planning as well as actual public works construction. Proponents of the conception of a full-fledged Missouri Valley Authority, with benefits for nine western states, will start the session with promises of support; this on top of an appropriation of $400,000,000 by the last Congress

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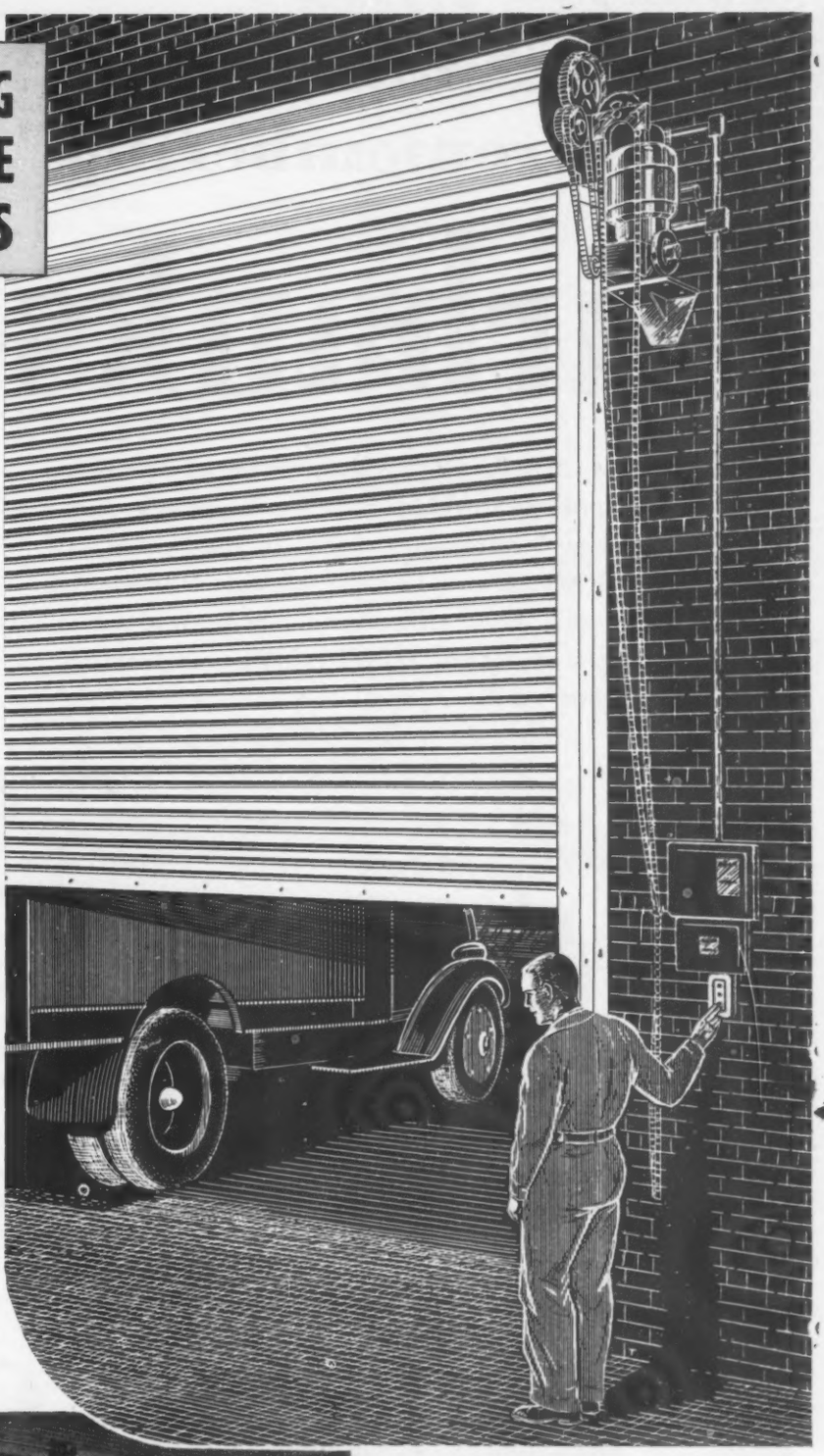

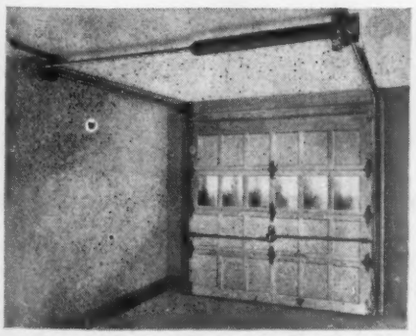

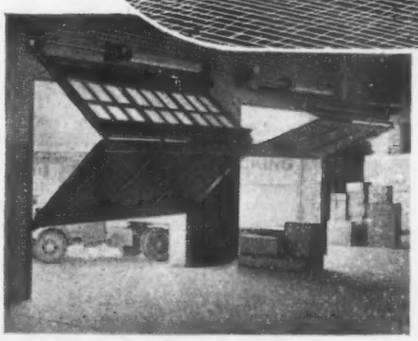

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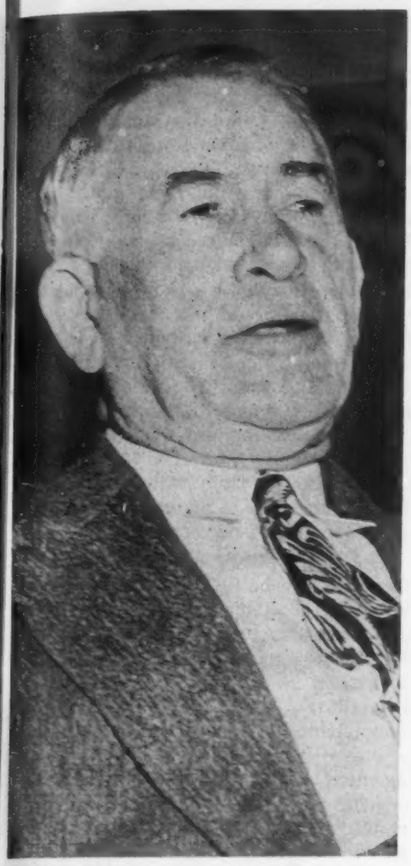

SEN. ALBEN BARKLEY
Majority leader of the upper house

for flood control along that stream and its tributaries. There will be much talk about other projects to provide work and employment in various parts of the country, particularly in the western states where there is great interest in building up industries.

It is of interest to note that no more is heard about "decentralizing industry"—at least in responsible quarters in Congress. Whenever there was mention of proposed "decentralization" during the 78th Congress, representatives from Pennsylvania, Illinois and Michigan would lose no time in asking whether this meant moving plants from Pittsburgh and Chicago, or automobile plants from Detroit, and locating them in the West. Now the emphasis is on building up backward sections, not on "decentralization."

In a series of hearings on the Pacific Coast recently, some members of the Senate Special Committee to Investigate the Effects of the Centralization of Heavy Industry were surprised to hear many West Coast businessmen testify that the movement of many materials and manufactured goods from the East to the West Coast was a good thing, and that they would welcome a revival of this trade to normal proportions after the war.

One of the matters to come up before the new Congress will be extension of the Price Stabilization act. This is a subject on which labor and other groups have taken a strong position in the past, but on which industry has advanced comparatively few arguments. This indifference is rather surprising to Washington observers who assume that the current strong pressures for higher wages, and floors under wage rates, should cause concern among manufacturers whose goods are covered by price ceilings. Price stabilization is a subject, many feel, on which manufacturers should be ready to speak their minds to Congressional committees when the proper time comes.

Another matter which businessmen and industrial managers will watch keenly is the development of tax studies in Congress. The House Ways and Means Committee is expected to begin focusing very shortly on a possible 1945 internal revenue bill. No reduction in tax rates of any importance is expected while the war is in progress. Of significance, however, is the fact that a Joint Congressional Committee on Internal Revenue Taxation, headed by Colin F. Stam, is studying postwar taxation in conjunction with Roy Blough, director of the Treasury's Division of Tax Research.

Agreement reached so far is that the tax system, particularly the taxes on corporations, should be simplified, that the excess-profits and the capital-stock and declared-value excess-profits taxes should be repealed in their entirety, and that as revenue requirements recede corporation taxes should be reduced promptly. The Ways and Means Committee has not yet scheduled any hearings for the new term but probably will afford early opportunity for representatives of business and industry to make their recommendations. In addition, subcommittees of the two postwar planning committees undoubtedly will hold hearings to develop postwar tax proposals; representatives of industry should watch for these and be adequately represented at them.

Air Transportation Legislation

Manufacturers interested in the future of civil aviation should watch the House Interstate and Foreign Commerce Committee which is expected again to be the arena for a battle as to the part the railroads and steamship lines will be permitted to play in owning and operating commercial air fleets.

This same committee is expected again to hold hearings on the Lea bill, reintroduced, which would establish a Civil Aeronautics Commission with independent status. This bill would instruct the commission to report recommendations for the postwar aviation industry to Congress, would instruct the postoffice to report on air delivery of all classes of mail, would set up a long-range program for development of airports, would encourage air travel by allowing discounts for given mileages traveled, would authorize a study aimed at preventing unwise multiple taxation on the aviation industry, would put all airline employes under the Railway Labor act.

One of the vital matters which the 79th Congress is expected to push to

SEN. ROBERT A. TAFT
One of the minority leaders of the Senate

conclusion is legislation to implement favorable postwar trade relations with other countries. There is intense interest in this subject for two main reasons: 1—Maintenance of friendly trade relations with foreign nations is seen as a means of increasing employment and prosperity in the United States, and 2—friendly trade relations are seen as an important factor in preventing future wars.

The subject is complicated and the legislative pattern has yet to be created. An encouraging factor is the absence of any serious controversies as to what is necessary to encourage and maintain healthy foreign trade relationships after the war. Representatives of the administration, business and organized labor, for example, appear to hold substantially the same views.

The program, already laid down in a preliminary way at the Bretton Woods and Dumbarton Oaks conferences, calls for stable foreign exchange rates under which exporters can be paid in their own currency, the elimination of various types of governmental discriminations which have hampered foreign trade relations in the past, reduction and revision of United States tariff rates to encourage other nations to exchange their goods for ours, and establishment of arrangements under which foreign trade may be conducted smoothly.

It is of considerable interest to note that in the testimony accumulated to

date by the Foreign Trade and Shipping Subcommittee of the House Special Committee on Postwar Economic Policy and Planning, it has been the general belief that United States private traders will be able to do business with the Russian government, with a minimum amount of government assistance or supervision.

On the other hand, the belief is gaining that revisions of the antitrust laws will be necessary to permit private industry in the United States to do business on favorable terms with nations of European countries, particularly Great Britain. The belief is gaining that to do business with the British, for example, we will have to deal with them in accordance with their preferences; that is, that we will have to be willing to enter into cartel arrangements with them. It is especially interesting to note that the Department of Justice has modified its former critical attitude on cartels. Department of Justice spokesmen in recent months have admitted the desirability of permitting United States manufacturers to enter into foreign cartel agreements under certain conditions.

Plans Foreign Trade Studies

In preparing to legislate to promote foreign trade, the new Congress will have much ground to cover. It will review the proposals for an international monetary fund and an international bank. It will study trade barriers of the past with a view to preventing their recurrence in the future. It will study the whole field of foreign investment, and the relationship of investment to foreign trade, and it will be interested particularly in the extent to which the government should participate in foreign investment, or back foreign investments by private business. It is entirely possible that a new government agency, to devote itself exclusively to enforcing and carrying out national foreign trade policies, may be created.

An important phase of this study will be a thorough investigation of the postwar utilization of the huge merchant marine we are building during the war. Much weight will be developed behind proposals that the United States dispose of a substantial part of this fleet to other countries which will be prepared to build duplicate fleets if they cannot acquire them from the United States. Current indications are that the Congress will map a policy under which the major portion of United States merchant vessels will pass into the hands of private operators who will be provided with subsidies ample to keep them going.

Another problem of considerable magnitude which the new Congress will inherit is the ultimate disposition of many of the large new industrial plants built at government expense during the war—largely steel, aluminum, magnesium and airplane manufacturing plants. Up to the present there is a lack of strong viewpoints as to what should be done with these plants, other than that they should be used to create employment and business prosperity in the postwar period.

Conversion of the wartime Smaller War Plants Corp. into a permanent peacetime agency to help small business will be considered by the 79th Congress; showing how the wind has been blowing, one of the bills introduced during the 78th Congress would have renamed this agency the Small Business Corp. and would have given it an appropriation of $1,000,000,000.

It is considered likely that the Smaller War Plants Corp. under some appropriate name, will become a permanent feature of our economy. At the same time there is likely to be considerable acrimonious debate on the subject. This is because a number of congressmen feel that the SWPC has been giving away a lot of service for which it should charge; that some of its policies are not good for small business in the long run.

The 79th Congress will be confronted with demands for a revision in the antitrust laws to protect companies against prosecution for violations during the process of reconversion. During the war, the War Production Board has had assurance from the Justice Department that no suits would be brought against companies for violations resulting from compliance with War Production Board and Office of Price Administration requests. Many manufacturers fear that assurances given by the present attorney general might not prove binding on his successor, or successors, and they want assurance from Congress that in carrying out requests of government agencies during the reconversion period they will not be held as being in collusion or in restraint of competition.

The 79th Congress, as usual, will be interested in protecting the interests of the farmer. There has been a disposition of late to believe that the time may have come when a permanent agricultural economic policy can be set up, thus obviating the temptation to add something new in the way of farm benefits every year or two.

In this frame of mind, the House Special Committee on Postwar Economic Policy and Planning conducted a series of hearings in Chicago in December during which it sought to find out what sort of a program would best serve the farmer from a long-range standpoint. The testimony related not only to the direct interest of agriculture, but the relation of the farm economy to the overall economy; an attempt also was made to define the farmer's interest in foreign trade.

Whether this study will bear fruit in the enactment of a permanent farm program remains to be seen.

One of the busy groups during the next Congress will be the House Special Committee on Postwar Military Policy. Recommendations received by that committee during the 78th Congress called for legislation to provide for a permanent compulsory military training system, maintenance of a large peacetime Army and Navy, and merchant fleet, encouragement of research work to improve and develop new war weapons, and special encouragement of military aviation. Legislation to accomplish these aims is expected to come up for attention, possibly before the end of 1945.

Labor leaders, as part of their plan to increase membership in their unions, will ask the new Congress to create a permanent agency to take the place of the President's Fair Employment Practices

(*Please turn to page* 406)

OUTLOOK BRIGHT: Chairman Andrew J. May, left, of the House Military Affairs Committee, and Lieut. Gen. Brehon Somervell, chief of the Army Service Forces, enjoy a hearty laugh as the general appeared before the committee in executive session recently. NEA photo

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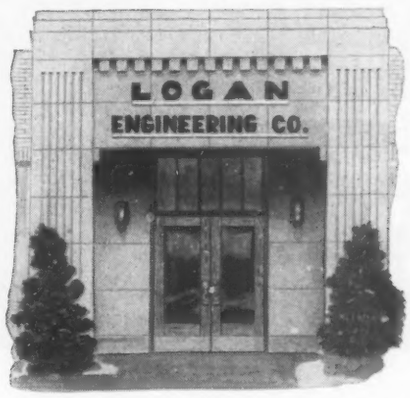

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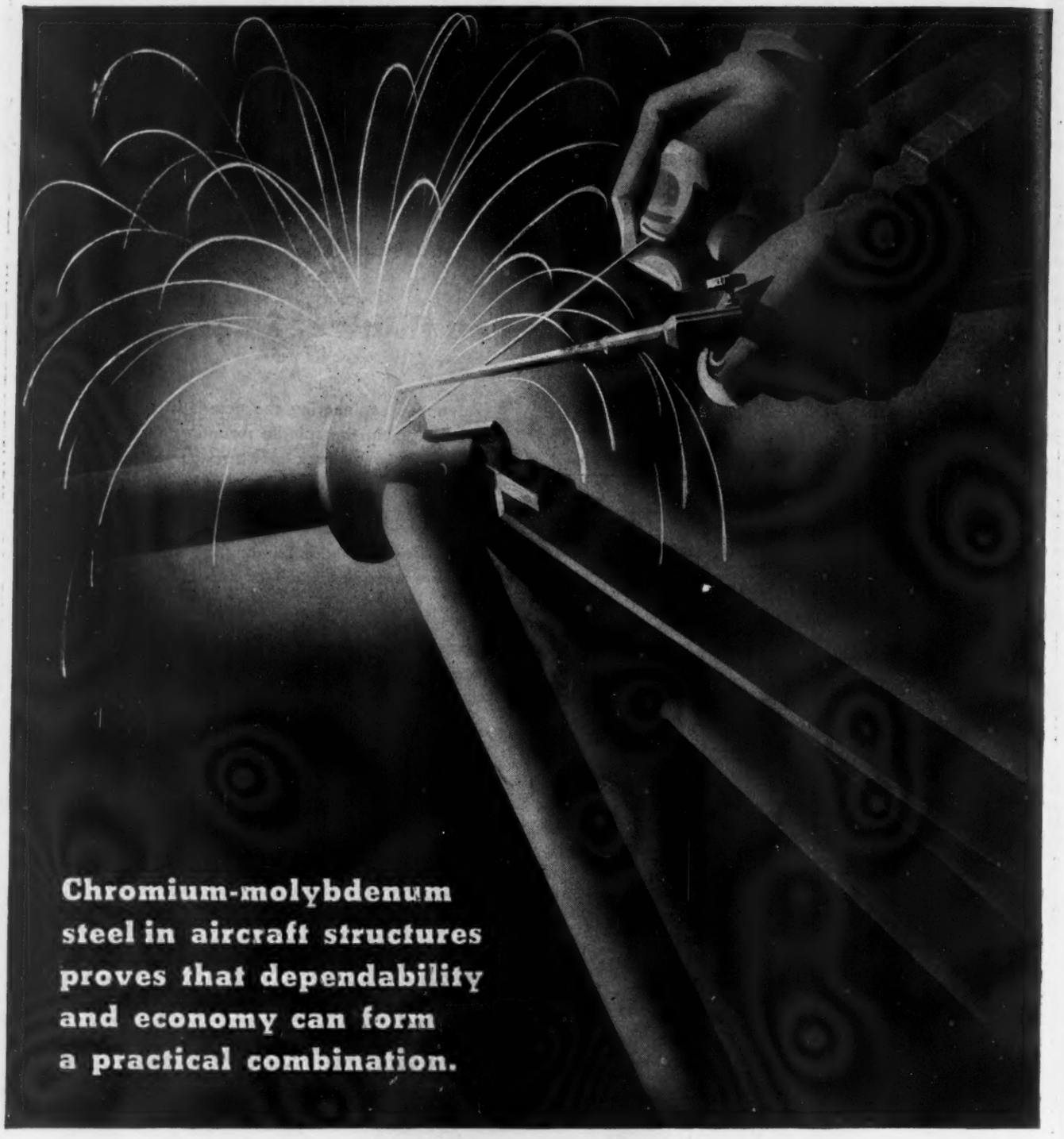

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MIRRORS of MOTORDOM

By A. H. ALLEN
Detroit Editor, STEEL

Mack prime movers for the United States Army will pull artillery and ammunition at speeds up to 35 miles an hour. They are equipped to travel over rough terrain and are fitted with six-wheel drive

Automotive industry points with pride to huge volume of its war production but views labor trends with alarm. Re-employment of veterans and postwar prices constitute vexing problems. Industry's goals are more jobs, larger output, better values

DETROIT

ON THE EVE of its fourth year of "production for destruction" the automotive industry finds much to which it can point with pride along with more than a few things to view with alarm. Never in the 40-year history of the industry has there been the hiatus in automobile output currently being experienced, and never in the history of the world has there been the co-operative concentration on war production engineered by a single industry.

Despite contract terminations, cutbacks, labor interruptions and other deterrents, war materiel has rolled from the motor plants at an undiminished pace. Monthly production expressed in dollar volume is shown in an accompanying table but it fails to tell the real story, principally because of a procession of price reductions resulting from the perfection of mass production techniques. Thus, while monthly totals held close to the 800-million dollar mark throughout the year, actually the physical volume of production moved steadily upward.

Gage the effect of price reductions by a few examples. A .50-caliber machine gun currently is being produced at a price 75 per cent under the original price in 1941; a .30-caliber gun at 84 per cent less. These startling savings have accrued from the fact production figures have steadily mounted—24,733 in 1941, 282,169 in 1942, 375,408 in 1943, and well over 400,000 last year. The same trend is observable in all categories of ordnance, aircraft parts, engines and the like. Repetitive production based on skillful tooling; conservation of materials through improved manufacturing techniques; slashing of man-hours by mechanization and conveyorization—these are the familiar automotive tools which, applied to any product, bring better quality at less cost.

Automotive know-how also is reflected in employment figures, the industry now having a labor force of 100,000 fewer than a year ago in the face of a higher physical volume of production.

In a sense, war production has become routine in the automotive industry. True, there is a continual flow of design changes, new products and major modifications in old products, but these revisions now can be digested in stride and with the exception of no more than a handful of so-called critical items, the needs of the military services in terms of equipment are well ahead of schedule.

At this stage of the game, it is idle to dwell on the statistical miracles the motor industry has performed. They are too well known and too often repeated. They are in fact almost taken for granted. It may be more appropriate to turn to some of the unfavorable aspects of both past performance and future outlook in the effort to balance the overall picture.

Productivity of Labor Declines

No. 1 consideration is labor. There has been a steady decline, dating as far back as 1937, in the productivity or man-effort of labor. Some estimates place the drop as high as 50 per cent from the level of 1939. It is of course a difficult thing to measure and, particularly under the driving impetus of war production with cost only a minor consideration, does not cause too much immediate concern. However, looking ahead to the restoration of a competitive peacetime economy, this falling off in individual effort has serious implications. The corrective, of course, is the establishment of sound incentive systems, based on careful scientific study, but at the present time it is difficult if not impossible to sell labor generally on incentives.

Perhaps labor collectively has determined to establish a new "normal" level of productivity from which to base incentives in the future. This would be credible were it not so clever. More probable is the likelihood that labor as a class sees itself firmly entrenched in the lap of government, and particularly now that the quadrennial coronation is over, with the result it has decided to continue holding down productivity to the level of the least efficient in the firm belief no restrictive action can be taken.

Beyond this basic philosophy of labor unions, however, is the more disturbing prevalence of general disrespect for all forms of authority. Even union leaders themselves are powerless to enforce discipline among their men. There is increasing acceptance of the belief that social progress and reward will be automatically guaranteed by a paternalistic government, and that individual effort is no longer any measure of compensation.

Motor industry executives are frank to say they expect no early reversal of this "gimme" attitude, and they look forward to mounting troubles with union labor, once the war emergency has ended. Strikes and more strikes appear inevitable in the postwar period as labor continues to "exploit" its gains. Establishment by government edict of wage floors, annual wage minimums, and all sorts of premium pay conditions is entirely possible.

There is no gainsaying the progress of automobile unionism under the flag of the United Automobile Workers-CIO. From a recently issued 200-page report by R. J. Thomas, president of the UAW-CIO, it is learned collective bargaining agreements have now been established with 1600 companies in the automotive and allied industries. Of these, about one-half provide for a union or closed shop, and 20 per cent more contain a maintenance of membership clause. Thus, the union boasts, more than 70 per cent of all agreements have "achieved a degree of recognition of the union over and above sole bargaining rights, as compared with only 56 per cent a year ago." One-fifth of the UAW contracts provide for checkoff of union dues and assessments. Three-fourths of the agree-

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Twenty-four-inch parabolic searchlight reflectors for the Navy are being turned out in volume by Chrysler Corp. The reflectors are made of stellite, and are finished so accurately that beams of light reflected from them will not deviate more than 0.008-inch in two miles

ments now give second and third shift workers an extra bonus; 79 per cent provide for paid vacation or bonus in lieu thereof, against only 34 per cent in 1940.

On the score of membership, as of June 30, 1944, the UAW had a paid-up membership of 1,065,610, nearly twice the total of three years ago. Income from dues and special assessments is now measured in the millions of dollars monthly, placing the operation of unions squarely in the category of big business.

The UAW-CIO is not content merely to watch over its membership, but definitely wants to be a partner with management in determination of policies. It has already enunciated specific plans for conversion of industry to peacetime production, disposition of government-owned facilities and equipment, surplus disposal, etc. For example, on conversion, the union urges "immediate establishment of an industry council in the automotive industry composed of representatives of government, management and labor, for the purpose of developing detailed plans for a speedy conversion when the war program permits, and to explore postwar marketing techniques to insure full distribution and continuous full employment."

Another vexing problem the industry now faces is the matter of veteran reemployment. Various companies have announced their views, and the UAW-CIO has made its recommendations, naturally at variance with those of the manufacturers. Principal question is over the employment of veterans who may never have worked prior to their period of service. Consensus of company opinion is that such veterans should be given seniority from the date of the start of Selective Service, May 1, 1940, and that such seniority be in effect at the time of application for employment. Against this viewpoint, the union would not have seniority become operative until after the employment of a veteran and the expiration of a probationary period. Clarification of these differences is high on the docket of decisions to be made in 1945.

Several months ago, when considered military opinion ran to the effect the war in Europe would be concluded by Oct. 1, the automotive industry realized quick decisions would have to be made on problems incident to plant clearance, disposal of inventories and equipment, contract termination and whatnot. The industry made its feelings known in no uncertain terms, because it realized failure to solve these matters in advance would seriously delay reconversion and extend unemployment during the changeover period.

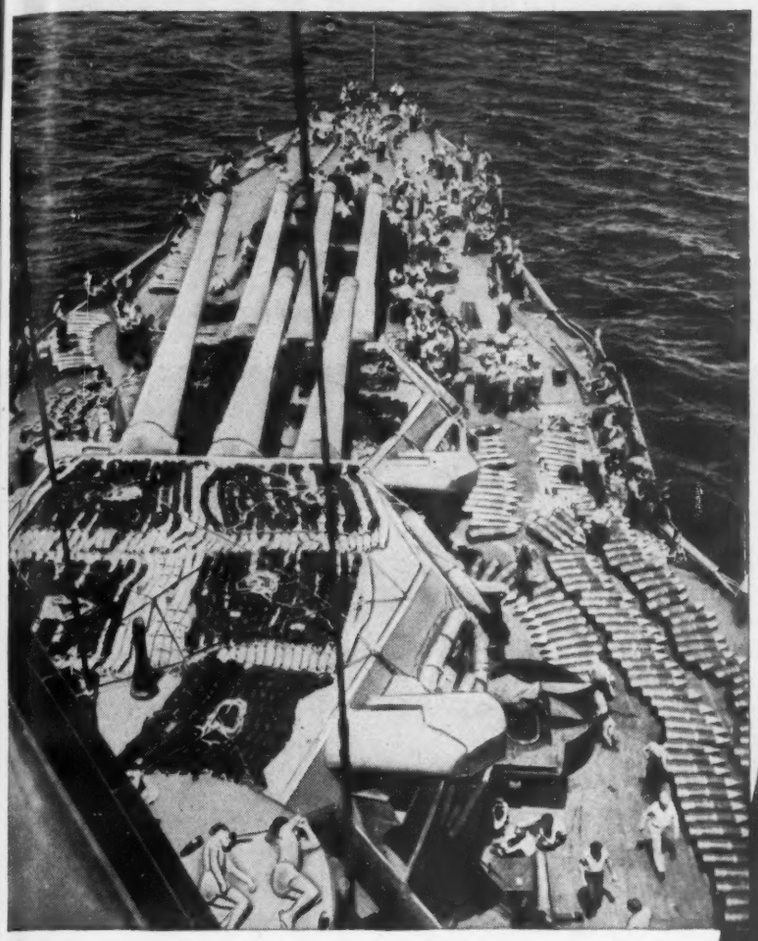
With the slowing of military progress in Europe, the problem became less pressing, so that at the turn of the year, the essential pre-reconversion steps were fairly well in hand. The industry was able to obtain WMC sanction on releasing up to 1 per cent of its engineering force to handle reconversion planning, and to expend up to $25,000 per month per plant on developmental work—admittedly an inconsequential sum but nevertheless a start. Orders for basic quantities of essential materials and parts have been placed with suppliers, on the basis of resuming production of cars on a limited scale, probably at a rate of around 2,000,000 per year.

The longer victory in Europe is postponed, the more favorable the outlook for a smooth reconversion of the automotive industry. Principal stumbling block at present is in respect to removal of government machinery and the purchase of essential items of new machine tools and equipment. Orders for the latter have now been in the hands of builders for as long as a year in some cases, but carry no preference rating and hence must wait in line behind military orders, lend-lease requirements and rated civilian orders.

Postwar prices of automobiles at the moment are a large question mark. Industry officials have gone on record with estimates indicating increases from 10 to 25 per cent may be necessary but there are many qualifying factors. First is the OPA which is now reviewing the subject and soliciting cost records and estimates from the industry. Second is the matter of parts and material prices. Suppliers have furnished estimates, but orders placed thus far contain the stipulation that prices will be negotiated at the date of shipment or shortly thereafter. In general, increases range from zero all the way to 30 per cent on parts and materials. To these must be added increased labor costs in the motor plants, estimated to hover around 30 per cent. The obvious inference is for higher automobile prices, but it must be remembered an automobile to a certain extent can be "built" to a predetermined price if necessary, and on this factor rests the actual price level to be expected.

While competition for business in the immediate postwar period will be insignificant in view of the hefty waiting market still no producer can allow his prices to go too far out of line with those of his competitor, nor can he permit value-per-dollar to drop below a competitive position, lest he incur the collective wrath of dealers and public who, in the last analysis, are the most potent price policemen.

Much has been made of the fact, particularly by those not too familiar with



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LONG rows of giant shells — powerful "teeth" that can bite through armor plate of enemy ships 16 miles away — line the deck of this U. S. battleship loading up somewhere in the Pacific. Shown above is but a fraction of the enormous quantity of munitions used by a single ship whose big guns are capable of firing a shell a minute.

Mass production of munitions, and of all types of precision parts — from aircraft engine components to breeches for 16-inch naval guns, as shown in insert — calls for faster machining, better finish, longer tool life . . . assured by the use of Texaco Cutting and Soluble Oils.

Texaco Cutting Oils lubricate the tools, carry away heat and prevent chip welding, thus lengthening tool life, assuring greater output.

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5 Points to Remember

1. Upon termination of war contracts, Government-owned production equipment must be rustproofed promptly, in accordance with *official instructions.*
2. Ordnance Specifications P.S. 300-4 contains *official instructions* for the complete processing of such equipment.
3. These instructions require that only rustproofing materials meeting Government specifications be used.
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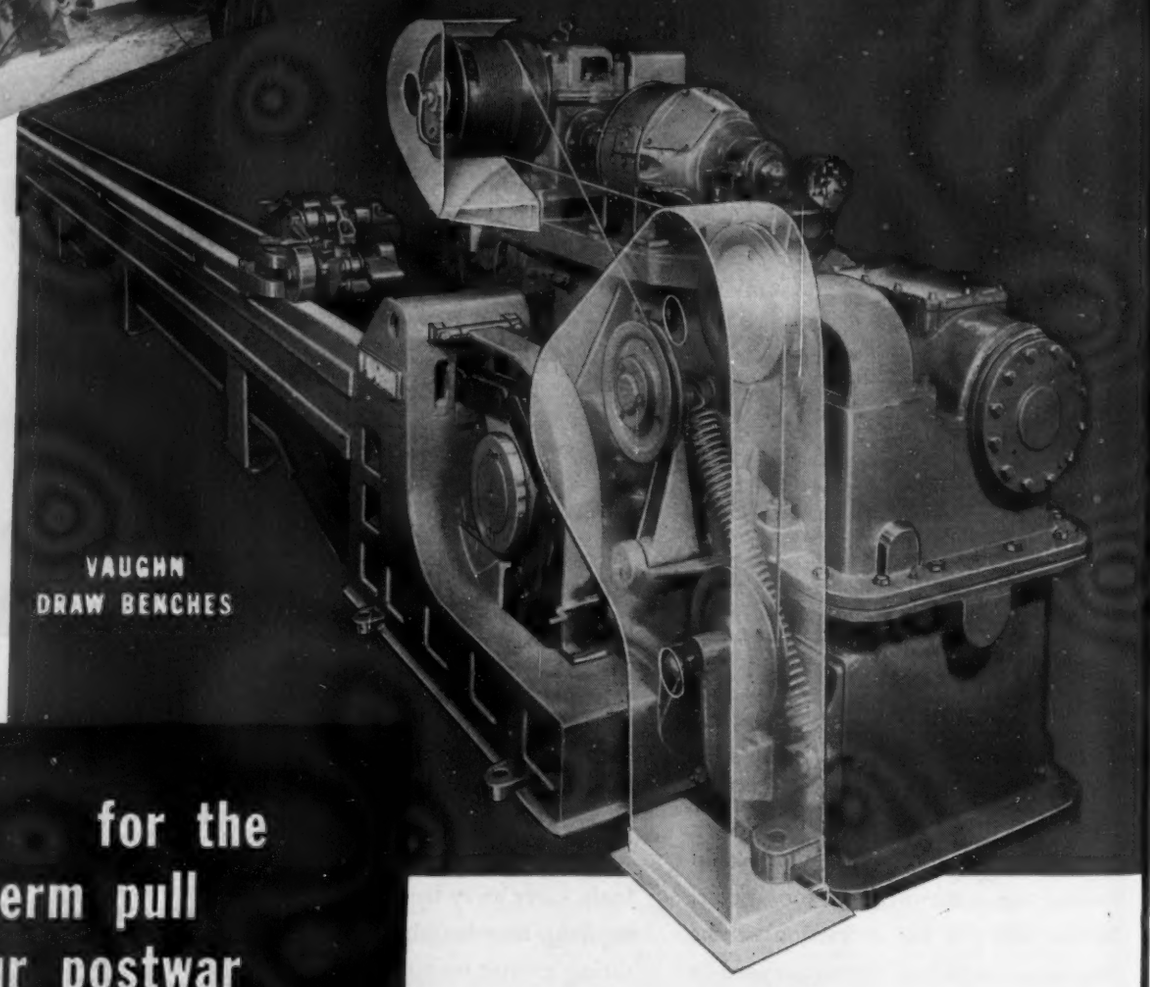

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COMPLETE COLD DRAWING EQUIPMENT . . . Continuous or Single hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.

automobile manufacture, that lessons learned in war production will be translatable into postwar economies in automobiles. Plausible though it may sound, it is actually not true. The principal lesson automobile builders have learned from the war is that by virtue of manufacturing know-how, any unfamiliar product, whether it be a combat tank or a bazooka, can be fitted into the pattern of mass manufacturing, with attendant speed, accuracy and economy of manufacture. There have been no startling discoveries, either in the way of materials or processes, which would appear to open the door to appreciably lower costs in automobiles.

This is not to infer the pressure from automotive management on postwar costs will be anything but terrific. It will mean a general belt-tightening and self-examination all down the line from parts suppliers to materials sources, and it will be a good thing. The war has made much of industry profligate in respect to costs; a return to the former basis will be a healthy thing, provided it is not carried too far as in past years when, for example, steel companies were offering automotive buyers special consideration in the form of $11 per ton price reductions on certain types of steel.

Accelerated Technical Knowledge

Wartime developments unquestionably have sharpened and accelerated technical knowledge but the peacetime application of this enhanced position still is to be determined. In respect to steel, for example, there have been notable advances along the following lines: Fatigue endurance and its improvement; precision heat treatment and its relation to physical characteristics; evaluation of the effect of alloys in general; interpretation and application of hardenability data; effects of special addition agents on steel. An important aid to this accelerated technical knowledge has of course been the relaxation of normal peacetime competitive barriers, with the resultant free interchange of information.

In the last analysis, selection of automotive steel will be on a price basis, and warborn knowledge has focused attention on apparent inequities in the steel price structure which may be in for early correction. Specifically, some interests contend the present "alloy base price" represents an artificial and illogical increment which tends to encourage use of carbon and high-alloy steels and to discourage development and application of low-alloy and so-called "needled" carbon steels. Furthermore, alloy extras on the present price structure make the continued use of multiple-alloy NE-type steels appear highly doubtful. Solution may be to increase extras on the high-alloy steels, leaving the lean-alloy grades in an intermediate position between the plain carbon steels and the high-alloy types.

Experience which automotive engineers have acquired in the production of aircraft engines may in due time be reflected in changes in automotive specifications. One logical expectation is that designers, reinforced with full knowledge of exactly what to expect from a given material, will work to a much lower factor of safety. In aircraft design, low weight is a primary consideration and hence a high factor of safety has been lowered by reliance on uniformity of material and workmanship. Again the governing factor is cost, and aircraft engines at $10 per horsepower are some distance from automotive engines at $1.50 per horsepower.

MILITARY AND CIVILIAN TRUCK PRODUCTION, TEN MONTHS, 1944

	Civilian	Military	Total
January	2,528	56,068	58,596
February	2,766	52,905	55,671
March	4,628	51,731	56,359
April	8,151	47,568	55,719
May	9,298	47,622	56,920
June	11,926	49,260	61,186
July	11,243	50,297	61,540
August	12,511	56,034	68,545
September	12,277	52,765	65,042
October	13,070	51,053	64,123
Total—10 mos.	88,398	515,303	603,701

Jeeps, military ambulances, and wheel-drive personnel carriers are included; half-tracks and armored cars are excluded. Military classification includes those procured by Army, Navy, Aircraft Resources Control Office, Canada and Treasury for military use; civilian classification includes those procured for civilian use under WPB limitation orders.

The outlook is unchanged as far as the appearance of the first postwar automobile is concerned. It will be a counterpart of the 1942 model, plus varying degrees of "face lifting" by means of new grilles, hardware, bumpers and minor decorative touches. Mechanically there will be no major changes, for there has been no time or personnel to develop them under the pressure of war production. Furthermore there will be no particular demand from buyers for improvements over 1942 models. The only demand will be for new cars and as many of them as possible. Rationing of initial sales appears the only fair method of distribution and while such rationing doubtless will be handled by the OPA or its successor, some of the automobile companies are of the opinion they themselves could handle this distribution problem more intelligently.

As it appears now, the industry will move forward at first under a plan of "combined operations," that is, sandwiching in limited output of automobiles with continuing production for the Pacific war theater. How long this policy may be necessary is anyone's guess, but certainly it is not likely to be suspended until the final surrender of Japan.

Seven-Million-Car Years Predicted

Once V-J day has been passed, the prospects are for moving ahead to a new peak of passenger car production, perhaps 50 per cent beyond the previous high point. Optimistic sales officials are even talking 7,000,000-car years for at least three years of full production, along with an increase in automobile registrations in the U. S. to the 40,000,000 level. Previous peak was around 34,000,000; currently they are close to 30,000,000, of which 25,500,000 are passenger cars.

On the basis of this planning, a considerable volume of new facilities will be required, and many of these are now on the drawing boards. They fall roughly into two categories—extension and decentralization of assembly plants, and expansion of bottleneck production facilities to balance out the entire manufacturing pattern so that all units can

"Hellcat" of the ground forces is the 19-ton, 55-mile-an-hour tank destroyer built by Buick and used extensively in the invasion of Europe

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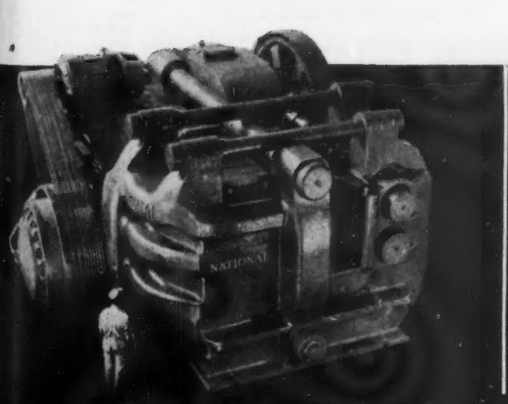

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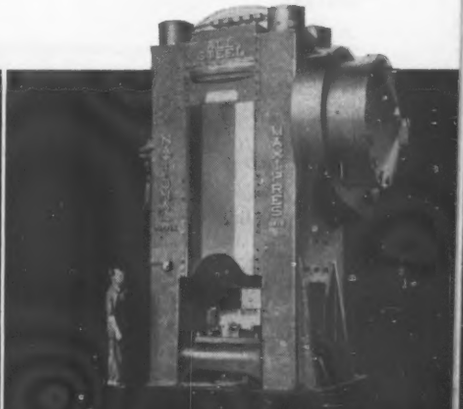

MAXIPRESSES

be operated on the same "shift" basis. So far, announcements have been forthcoming only from Ford and the General Motors units. Each of these producers has about a dozen new plants in prospect, and virtually all of them tentatively located outside the Detroit area. In general, it can be said the feeling of the industry is that war-built plants are not particularly suited to postwar needs, either physically or geographically, and new buildings will be erected at strategic localities.

The past year has witnessed a more than ordinary amount of personnel reshuffling throughout the motor plants. First was the resignation of C. E. Sorenson, manufacturing head of the vast Ford plants who after 30 years broke with Ford and later assumed the presidency of Willys-Overland and began drawing grandiose plans for postwar production of civilian jeeps. Further recasting of the Ford organization saw Henry Ford II, 26-year old grandson of the founder, elevated to the rank of executive vice president, and a concerted expansion and reorganization of the Ford engineering department.

Fisher Brothers' Plans Secret

Another significant milestone was the departure of the Fisher brothers from the ranks of General Motors. Future plans of these wealthy brothers, who started their careers in their father's carriage factory at Norwalk, O., have remained cloaked in secrecy, although there is some evidence to support the belief they may eventually organize a new motor company and build a car under their own name.

Fortunes of the Graham-Paige company received a lift with the association of Joseph W. Frazer as chairman of the board, with the backing of wealthy associates. Their plans call for eventual manufacture of a radically new design of motor car, plus farm tractors and implements.

On the road back from a devastating war to a sound, progressive peace with renewed emphasis on production for consumption, the automotive industry will be in the forefront. More jobs, larger production, better values are the goals now as they have been in the past. Given an even break by the labor unions and by the government, these goals can be attained.

Classification of Automotive Industry Production

	Per Cent	
	1943	1944
Aircraft, engines and parts	39.1	45.1
Military vehicles and parts	26.5	26.8
Tanks and tank parts	14.2	11.3
Marine equipment and spares	6.6	7.3
Guns and gun components	7.3	4.0
Ammunition	3.4	2.6
All other	2.9	2.9

AUTOMOTIVE INDUSTRY WAR PRODUCT DELIVERIES

(Covering approximately 1000 companies in the motor vehicle and parts industries, and adjusted to eliminate effect of inter-company shipments.)

	1943	1944
Jan.	$595,491,239	$805,849,193
Feb.	606,251,666	778,561,524
Mar.	649,993,057	754,425,355
April	668,063,287	773,300,770
May	698,688,645	790,683,494
June	743,007,441	776,336,271
July	779,358,588	739,312,491
Aug.	796,628,106	811,106,293
Sept.	777,322,730	744,934,044
Oct.	781,594,510	790,000,000x
Nov.	760,739,370	780,000,000x
Dec.	804,191,062	770,000,000x
Total	$8,661,329,701	$9,320,000,000x

xLast quarter estimated.

AUTOMOTIVE INDUSTRY'S RECONVERSION TIMING CHART

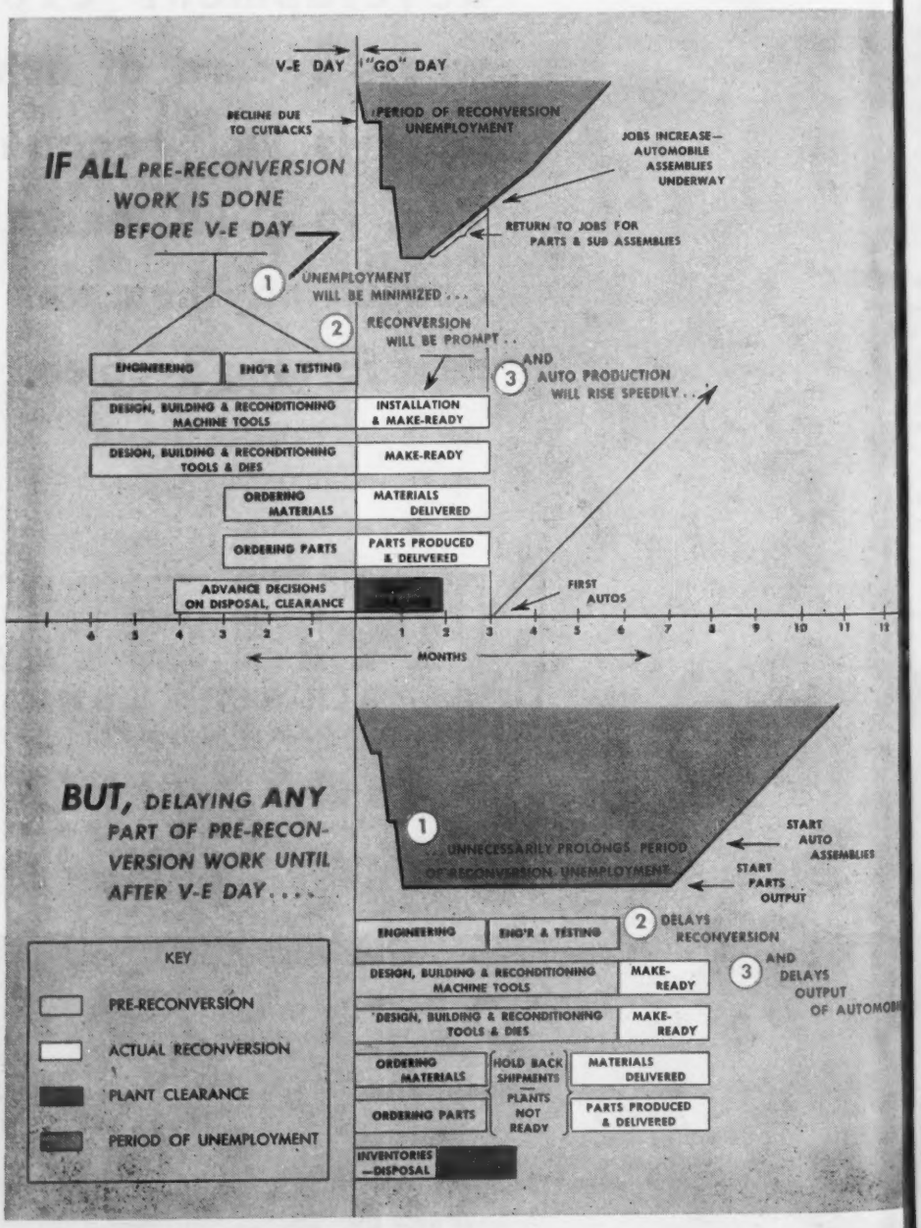
V-E DAY
"GO" DAY
DECLINE DUE TO CUTBACKS
PERIOD OF RECONVERSION UNEMPLOYMENT
JOBS INCREASE—AUTOMOBILE ASSEMBLIES UNDERWAY
RETURN TO JOBS FOR PARTS & SUB ASSEMBLIES
IF ALL PRE-RECONVERSION WORK IS DONE BEFORE V-E DAY
1 UNEMPLOYMENT WILL BE MINIMIZED . . .
2 RECONVERSION WILL BE PROMPT . .
3 AND AUTO PRODUCTION WILL RISE SPEEDILY . . .
ENGINEERING
ENG'R & TESTING
DESIGN, BUILDING & RECONDITIONING MACHINE TOOLS
INSTALLATION & MAKE-READY
DESIGN, BUILDING & RECONDITIONING TOOLS & DIES
MAKE-READY
ORDERING MATERIALS
MATERIALS DELIVERED
ORDERING PARTS
PARTS PRODUCED & DELIVERED
ADVANCE DECISIONS ON DISPOSAL, CLEARANCE
FIRST AUTOS
6 5 4 3 2 1 1 2 3 4 5 6 7 8 9 10 11 12
MONTHS
BUT, DELAYING ANY PART OF PRE-RECONVERSION WORK UNTIL AFTER V-E DAY . . .
1 . . . UNNECESSARILY PROLONGS PERIOD OF RECONVERSION UNEMPLOYMENT
START AUTO ASSEMBLIES
START PARTS OUTPUT
2 DELAYS RECONVERSION
3 AND DELAYS OUTPUT OF AUTOMOBILES
KEY
PRE-RECONVERSION
ACTUAL RECONVERSION
PLANT CLEARANCE
PERIOD OF UNEMPLOYMENT
HOLD BACK SHIPMENTS
PLANTS NOT READY
INVENTORIES —DISPOSAL

Chart by Automotive Council for War Production

He came to save your plant MAN HOURS

and stayed to save you money!

The manpower crisis forced many plants to install safety programs under full-time safety directors. Management recognized this step as necessary to keep production up. Experience has shown it equally wise from the economy standpoint. In many cases, especially where accident cost is paid from insurance within the plant, the dollar-and-cents savings proved many times the cost of the new safety program. This is a practical reason why more plants will retain complete safety programs even after war pressure is off manpower.

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WING TIPS

U. S. attains supremacy in air by airplane industry's application of mass production techniques coupled with extensive research and development program. Sharp deflation from present output level recognized as inevitable. Industry holds realistic view of postwar prospects

LIFTING of military restrictions on many hitherto secret figures relating to the overall aircraft manufacturing picture throws into sharp focus the tremendous production miracle which in the space of three years has made this country supreme in air power. In these three hectic years since Pearl Harbor, better than 230,000 military airplanes in all categories have been delivered, with combined weight, including spares, of over 2,000,000,000 pounds. Concurrently has come production of over 600,000 aircraft engines, with gross horsepower just short of 1,000,000,000. Including airframes, engines, propellers and spares, this enormous outpouring of equipment had a total valuation approximating 30 billions of dollars, placing aircraft far in the lead of all classifications of war goods.

Employment in plants producing air frames, engines and propellers has expanded nearly tenfold since 1940, and currently is running well over 1,000,000 in plants of prime contractors, with another 1,000,000 employed in plants of thousands of suppliers and subcontractors. Extent to which women have come into aircraft employment is shown by the fact nearly 40 per cent of present employment is female, against only 5 per cent three years ago.

For the first time a breakdown of military production by types is available. In the period from July 1, 1940, to the end of the past year, total output of 253,000 aircraft is made up of 88,500 bombers, 74,500 fighters, 20,000 transports, 55,000 training planes, 11,000 communications planes, 2500 naval reconnaissance units and 1500 special purpose craft. Over this 4½ year period, there has been a gradual shifting in emphasis on various types. As might be expected, trainers dropped from 22 per cent in 1941 to only 2 per cent last year; and on the other hand bombers rose from 50 per cent in 1941 to 64 per cent last year, with fighter planes holding even at about 22 per cent. Transports increased steadily from 5 per cent to 11 per cent last year.

Combat losses, obsolescence, wearing out, training accidents and shipping losses obviously have removed an appreciable proportion of these aircraft, perhaps as high as 20 per cent, concentrated principally in bombers, fighters and trainers. But even such losses leave a fleet of probably better than 200,000 military airplanes, all less than five years old. From this total must be deducted a considerable number of exports to other United Nations under terms of Lend-Lease. The Russians, in particular, have received large quantities of U. S. fighter planes. In any event, it is a safe assumption the U. S. air fleet may be the equal of that of the rest of the world combined.

To accomplish such a production miracle in so short a time has not been a simple project. Primarily the matter of manufacturing facilities is involved. Again, dating from July 1, 1940, facilities expansions to the tune of $3,721,000,000 have been authorized, 90 per cent of them government financed. Out of this total, 90 per cent had been completed by last summer, although new authorizations for the first half of the year amounted to $111,000,000. So, roughly, what it simmers down to is a four-billion dollar plant to supply 30 billions of product.

Quantity production of aircraft has brought startling reductions in the man-hours of labor required per plane, or in the number of pounds of output per employe. Figures for the past five years covering operations in the California plants of Douglas make an interesting comparison:

Year	Direct employes	Pounds produced	Pounds per employe
1940	9,915	4,861,000	490
1941	15,565	10,832,000	697
1942	31,780	35,414,000	1,116
1943	50,020	85,487,000	1,710
1944 (6 mos.)	40,930	111,684,000	2,725

Direct man-hours required in production of the Douglas A-20 two-engine attack bomber, now superseded by the A-26 model, in June of last year were only one-twentieth of the time required in 1940, and production cost was only 23 per cent of the original figure.

While improvements in manufacturing processes and in the efficiency of employes have contributed in an important way to these savings, it must also be remembered the average weight of planes built has been increasing steadily, so there would be a logical increase in per capita production expressed in terms of weight. Thus, in 1941 the average weight per airframe produced was 3945 pounds, while at the end of last year, this unit weight average was close to 10,500 pounds.

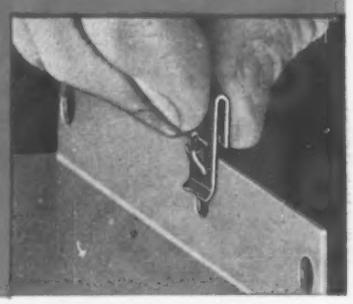
The list of American warplanes is impressive, one of the latest published containing a total of 85 types of fighters, light bombers, medium bombers, heavy bombers, transports, advanced trainers, basic trainers, primary trainers, observation and liaison types. About 20 of those listed are no longer in production, and at least a half a dozen later models now made public are not shown. In recent weeks, it has been disclosed three more

Completed B-29 is towed into the night from the final assembly line at the Boeing-Wichita plant, soon to take off to bomb Japan

ONE OF A SERIES PORTRAYING THE "SPEED NUT FAMILY OF FASTENINGS"

"J" TYPE SPEED NUT

Self-Retaining for BLIND LOCATION ASSEMBLY



Positioning "J" nut over hole in flange.

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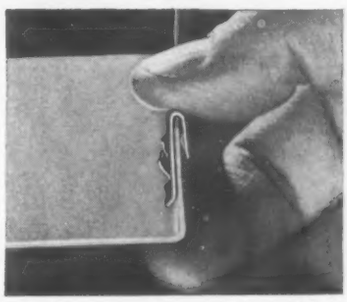
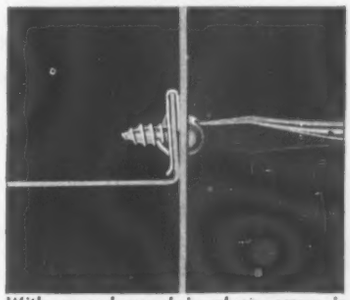
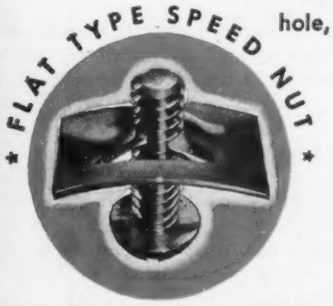


As nut is pressed on, extrusion on lower leg snaps into hole.



With second panel in place, screw is driven. Access to opposite side ★ unnecessary.



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FASTEST THING IN FASTENINGS

types of heavy bombers are now or shortly will be in production. They are the B-35, the B-36 and the B-42. Manufacturers have not been revealed, but George Lewis of the National Advisory Committee for Aeronautics told a Senate committee the B-36 would be the largest bomber ever built in this country, exceeding in size even the Boeing B-29 Superfortress and the Consolidated B-32 Dominator.

The past year saw the christening of the first of this U. S. fleet of battleships of the air, the B-29, culminating three years of preparatory work. Four large plants across the country are assembling this giant of the skies. It will be joined this year by the B-32 which Consolidated is building at San Diego, though not nearly on the production scale of the B-29.

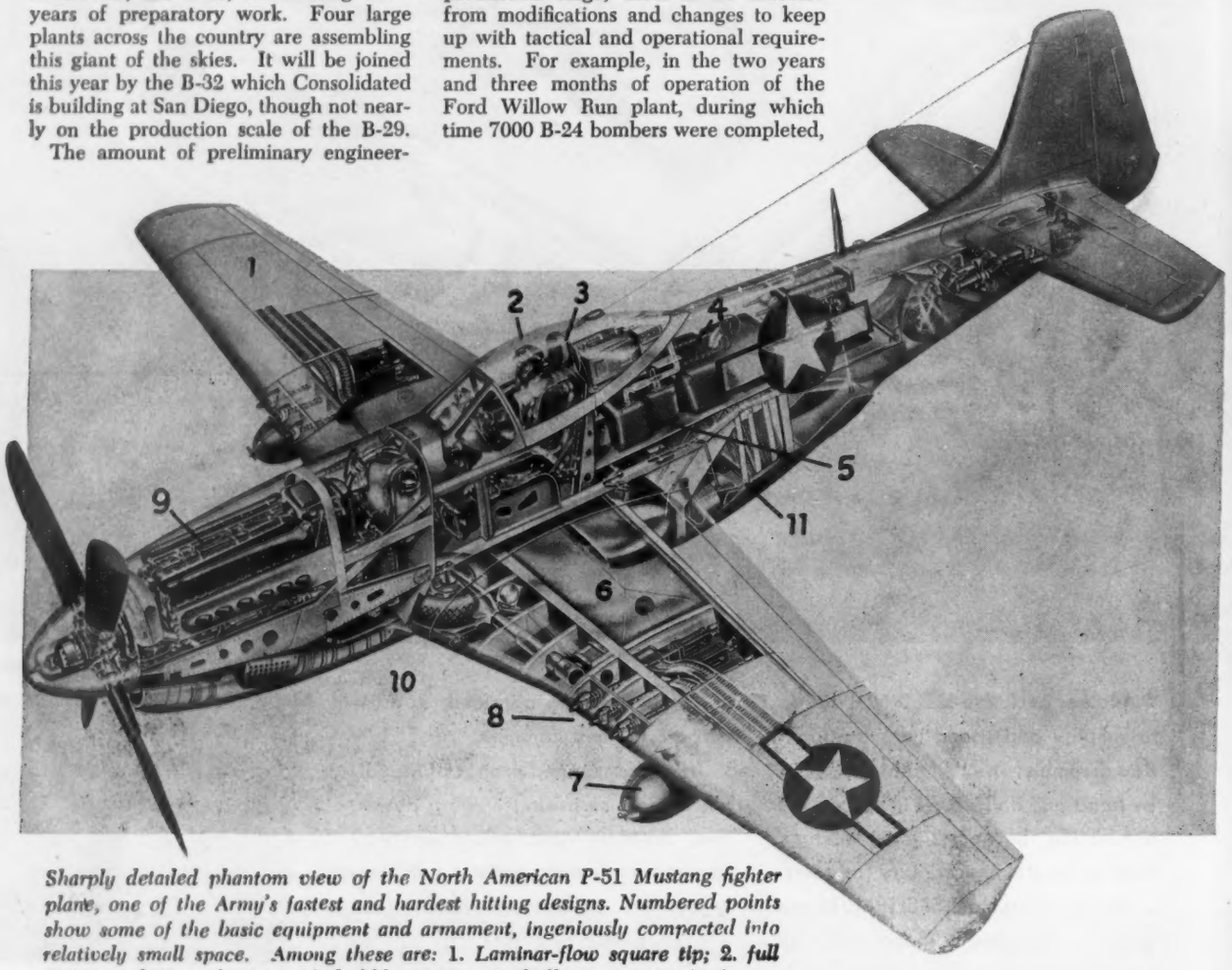
The amount of preliminary engineering, designing and testing preceding initial production of a new military airplane is seldom realized. It is measured in the hundreds of thousands of man-hours for a model like the B-29. Actually, it is probably a fair statement that all warplanes in use today had their original drawing board birth prior to Pearl Harbor. Three years is still an accepted yardstick to measure the time between first conception and first flight of a production model.

To rush this process may cause serious trouble as in the case of the General Motors P-75 fighter plane, contract for which was terminated last fall after only a few had been built and flown. Officially, the Air Forces said changing requirements in battle zones made the cancellation necessary, but in aircraft circles it is believed the design was rushed through too fast, with insufficient amount of wind tunnel and other preliminary testing, resulting in failure of the plane to live up to planned performance.

Even when designs finally reach the production stage, there is no surcease from modifications and changes to keep up with tactical and operational requirements. For example, in the two years and three months of operation of the Ford Willow Run plant, during which time 7000 B-24 bombers were completed, better than 1000 master design changes had to be absorbed, and they are still continuing. That is an average of one major design change for every seven ships built.

It is no mere perverseness of the military which directs this unending flow of alterations to producers of aircraft and engines therefor; rather it is the so-called fluidity of war and the rapidity of technical progress in aviation during a war. To keep ahead of the enemy's best, a continuing program of research and development is essential, plus the means for quick transmittal of operational difficulties back to the plants of plane builders. Today's war is in fact being fought with yesterday's airplanes, yet they must be "dressed" or modified in the light of tomorrow's requirements.

Many significant improvements in the basic design and construction of warplanes appeared in the past 12 months. Some are still wrapped in military secrecy; others have been detailed in sketchy fashion. Of principal interest to the metals industries is the progress made in jet propulsion, concerning which there has been more fantastic writing than on any other subject in recent aviation history.



Sharply detailed phantom view of the North American P-51 Mustang fighter plane, one of the Army's fastest and hardest hitting designs. Numbered points show some of the basic equipment and armament, ingeniously compacted into relatively small space. Among these are: 1. *Laminar-flow square tip;* 2. *full vision cockpit enclosure with bubble canopy;* 3. *bullet-proof seat back protects pilot;* 4. *bottles to provide oxygen for pilot;* 5. *two-way radio;* 6. *self-sealing gas tanks;* 7. *bomb load,* 1000 *pounds under each wing;* 8. *six* 50*-caliber machine guns in wings;* 9. 1520 *horsepower supercharged engine and automatic variable pitch propeller;* 10. *retracted landing wheel;* 11. *engine radiator and intercooler*

Jet propulsion for aircraft must be divided into several classifications. First and simplest is the use of powder-filled auxiliary rockets for a jet-assist effect in takeoffs. Both land and water-based planes have been fitted with such devices, which greatly assist the rate of climb and shorten takeoff distance. When the rockets are expended, they are dropped from their supporting racks, usually under the wings and fairly close to the fuselage.

The first airplane to fly in this country with pure jet propulsion engines was the Bell P-59A Airacomet, closely resembling

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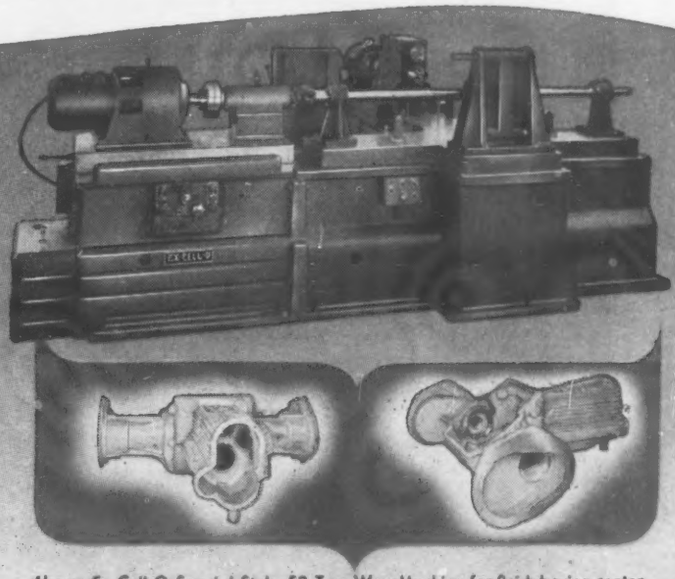

Above: Ex-Cell-O Special Style 58 Two-Way Machine for finish boring center and both ends of differential transmission case (of chrome nickel iron—shown in two views). This Ex-Cell-O machine combined several operations formerly necessary, and greatly increased production.

Below: Ex-Cell-O method of bolted construction. Linked in this manner are the wing sections of the machine that carry the spindles, and the center pad section that carries the work fixture. This Ex-Cell-O feature of construction provides not only added strength and rigidity but greater flexibility. When desired to machine a part of different dimensions the center section can easily be removed and a section of different size substituted.

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Above: Bulletin on Ex-Cell-O Precision Way Machines For Higher Production and Improved Accuracy. Write for free Ex-Cell-O Bulletin 31631.

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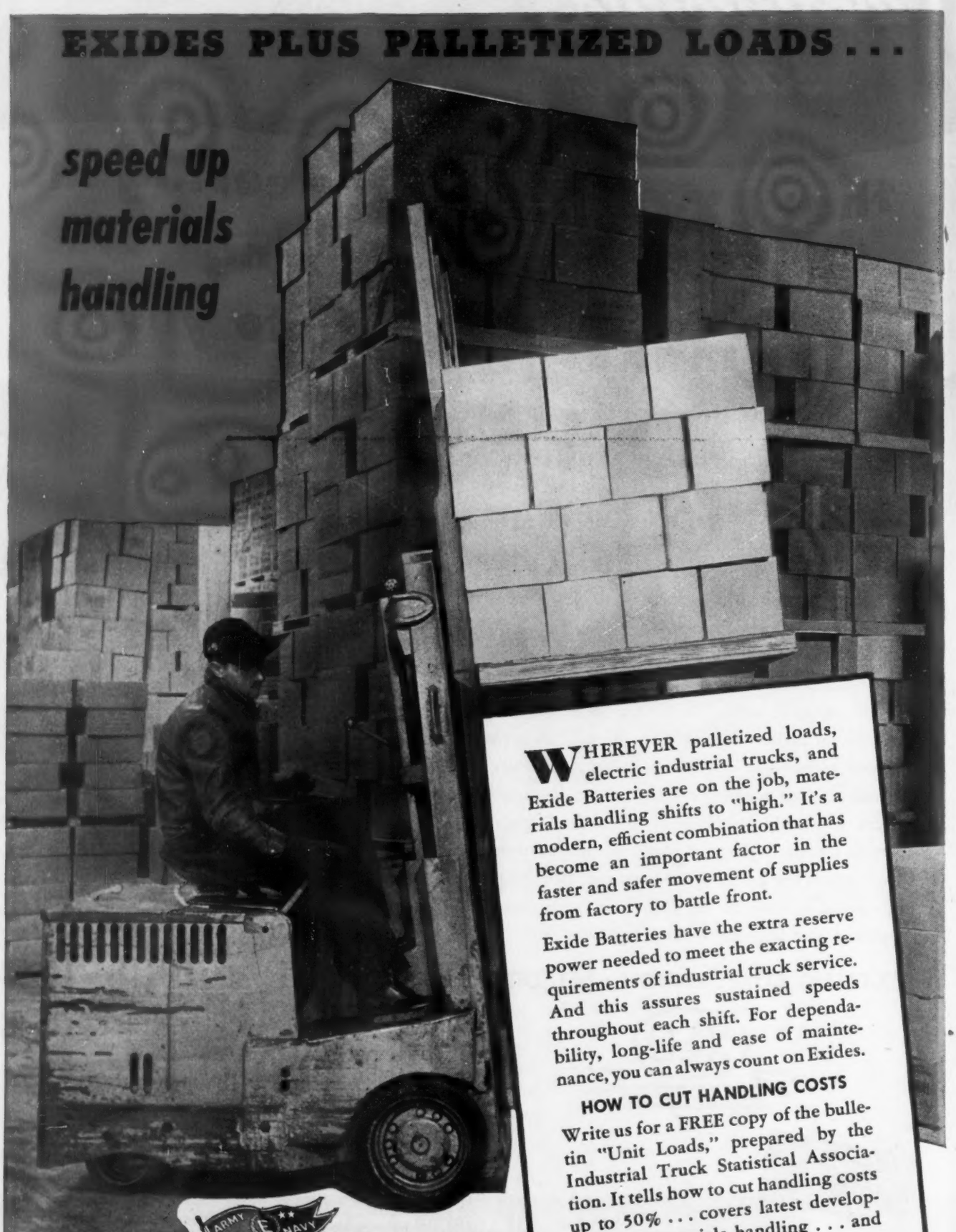

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ARMY E NAVY

Exide BATTERIES

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Indicative of the variety and grotesque shape of typical aluminum forgings used in combat airframes is this view of one of the inspection benches at the Dodge aluminum forge plant in Detroit. This plant has produced literally hundreds of types of forgings for over 20 different fighter planes and bombers and was built specifically for this type of production. Steam hammers range up to 20,000-pound size. Most forgings are of 14ST alloy

the Bell Airacobra except for the installation of twin jet engines instead of the conventional Allison engine and propeller. The engines were based on designs of a British engineer, Capt. Frank Whittle, and were built by General Electric. Essentially they comprise a coaxially mounted blower-compressor and gas turbine, the former ahead of the latter and serving to compress the inrushing blast of air from a frontal air scoop, then delivering it to the turbine after passing fuel jets which inject atomized fuel to make an explosive mixture. "Hot" wires or spark plugs ignite the mixture and the resulting explosive force drives the turbine and then is ducted through a rear venturi, the reactive force serving to propel the plane.

While the Airacomet performed successfully, it apparently became obsolete shortly after its appearance, for production contracts were sharply scaled back. Principal objections to this type of engine are the high fuel consumption at speeds below 500 miles an hour and the comparatively short life of the engine. Temperatures resulting from a continuously exploding gasoline mixture impose severe demands on turbine blades particularly and on other parts of the engine as well, so that continuous operation is not possible beyond a short period. In fact the engine would not have been successful at all were it not for perfection of a suitable alloy for the turbine buckets. Based on experience with turbosuperchargers, a material known as Vitallium—similar to Stellite—was used and cast into the bucket form. The alloy is unmachinable and hence was precision cast by the lost wax process. Later research has indicated a change to Hastelloy B, forged to shape, but little has appeared on this development.

This type of jet engine obviously would lend itself to a combination type of operation—that is, both propeller and jet. At lower speeds the compressor-turbine shaft might be coupled to a propeller and at higher speeds switched over to pure jet force. In fact, it appears strange the first application of the gas turbine, which is essentially what the engine is, was not in a propeller-type installation; certainly some experiments in this direction can be looked for.

The German V-1 robot bomb, which made its appearance in 1944, represented an ingenious application of the jet principle to an impulse-reaction type of "engine" of amazingly simple and low-cost design. Briefly, all it comprises is a long, tapered steel tube externally mounted, with a flap-valve grille at the front in which are incorporated six fuel jets. Inrushing air forces the flaps open, fuel is sprayed into the air, ignited by a hot wire, exploded through a venturi and the force of the explosion both drives the bomb forward and closes the flap valves, after which the entire cycle is repeated several hundred times a minute. No particular metallurgical complications are involved in this type of power unit, but at that it had only limited life, probably burning out in well under an hour if allowed to continue in operation. For experimental purposes, this type of engine was duplicated by Ford Motor Co. and attached to winged bombs manufactured by Willys-Overland.

At year-end, first details of the V-2 and V-3 jet-propelled bombs were released by the British, revealing them to be much more complicated and powered by liquid oxygen and alcohol combusted through a venturi, with a maze of controls and accessories including turbine-pump unit, nitrogen, hydrogen peroxide and permanganate supply, electric motors, radio equipment, chain-driven control vanes and a comparatively small one-ton explosive war head. They were unique engineering achievements.

Practical application of jet propulsion as yet is some distance away, despite the fact the AAF has said its present fighter plane models, such as the P-47 Thunderbolt, the P-51 Mustang, the P-38 Lightning and the P-61 Black Widow, represent the last fighter planes to be built with conventional gasoline engines, suggesting future models will be jet pro-

EMPLOYMENT IN AIRFRAME, ENGINE AND PROPELLER PLANTS AND PER CENT FEMALE EMPLOYMENT

Year	Airframe	Per cent Female	Engine	Per cent Female	Propeller	Per cent Female	Total	Per cent Female
Jan., 1941	146,197	NA	41,329	NA	6,609	NA	194,135	NA
Jan., 1942	341,603	5.5	104,156	3.8	14,597	3.8	460,356	5.0
Jan., 1943	770,471	35.6	219,084	18.8	38,359	16.4	1,027,914	31.3
Aug., 1944	769,282	40.0	317,346	30.4	53,291	28.3	1,139,919	36.8

Source: U. S. Dept. of Labor, Bur. of Labor Statistics, Construction and Public Employment Division.

pelled. Germany has at least two-jet-propelled fighter planes now in action. As far as is known, the United Nations have none. Commercial use of this type of power is still remote.

Application of water injection to engines of conventional types of fighter planes during 1944 showed interesting possibilities, especially as a means of stepping up "burst" horsepower in combat. Systems were being installed on both radial and liquid-cooled engines, and gave pilots an extra power edge in maneuvering against the enemy. Water is injected only in short spurts, controlled by the pilot, although on tests it has been applied successfully for as long as 15 minutes.

Air-borne radar equipment is a highly secret development but one being pushed aggressively. The only warplane yet announced as radar - equipped is the Northrop P-61 twin-engine night fighter, although there are undoubtedly others. The P-61 Black Widow is said to mount a unique type of binocular radar. The purpose of radar briefly is to detect objects some distance ahead of the attacker by means of projecting short-wave electrical impulses, some of which rebound from the undisclosed object, and are recaptured and indicated by the radar equipment.

Numerous other minor embellishments have been perfected to sharpen and extend the performance of warplanes. Auxiliary jettison-type gasoline tanks, of compressed paper, aluminum or steel, constitute one innovation to extend the range of aircraft. Remote control systems for electrically sighting and operating gun turrets on large bombers are another. The latter arrangement is a feature of the B-29 Superfortress, and permits gunners to "gang up" all the gun turrets and operate them from inside the pressurized cabin, or they may be operated manually if preferred. Mounting of cannon up to 75-millimeter size on light bombers is still another successful modification.

Important strides have been made in supercharging, most of the large engines now produced being equipped with two-speed two-stage supercharger systems. One stage is driven by exhaust gases through a turbine; the other mechanically geared. A P-51 fighter plane so equipped is said to have been operated at a speed of around 540 m.p.h. and at low altitude, although this practice is not recommended and results in inordinate engine wear. The two stages of supercharging are aimed primarily at improving high-altitude performance.

There are indications the reciprocating type of internal combustion engine has reached the peak of size and power for aircraft use. Largest engines now in production are the Allison 24-cylinder 3420-cubic inch displacement model and the Wright 18-cylinder radial 3350-cubic inch displacement model, each providing close to 3000 takeoff horsepower. Going into production is a 28-cylinder four-row radial with around 4300 cubic inch displacement, but it well may run into trouble with cooling the rear banks of cylinders, in view of the serious difficulties experienced on this score by the Wright 3350 engine over the past two years.

Aluminum and steel continue to be basic aircraft materials, although the trend toward increasing use of magnesium in both cast and wrought forms remains upward. The aircraft industry consumes approximately two thirds of

(*Please turn to Page* 404)

TOTAL FLOOR SPACE OF AIRCRAFT, ENGINE AND PROPELLER ASSEMBLY PLANTS

(Sq. ft., 000 omitted)

Year	Aircraft	Engines	Propeller	Total
Jan., 1940	9,606	3,018	492	13,115
Jan., 1941	17,943	6,463	1,050	25,456
Sept., 1941	31,786	10,651	1,734	44,171
Jan., 1943	77,536	31,829	5,240	114,605
Dec., 1943	110,423	54,189	6,838	171,450
June, 1944	108,363	55,220	3,616	167,199

Source: 1940-1941: Questionnaires of the Aeronautical Chamber of Commerce. 1943: Aircraft Resources Control Office, Report 15 (Monthly Summary). 1944: Quoted from "Labor Statistics for Aircraft Industry" prepared by Manpower Branch, Air Technical Service Command, Wright Field, Dayton.

DOLLAR VALUE OF AIRFRAME, ENGINE AND PROPELLER PRODUCTION

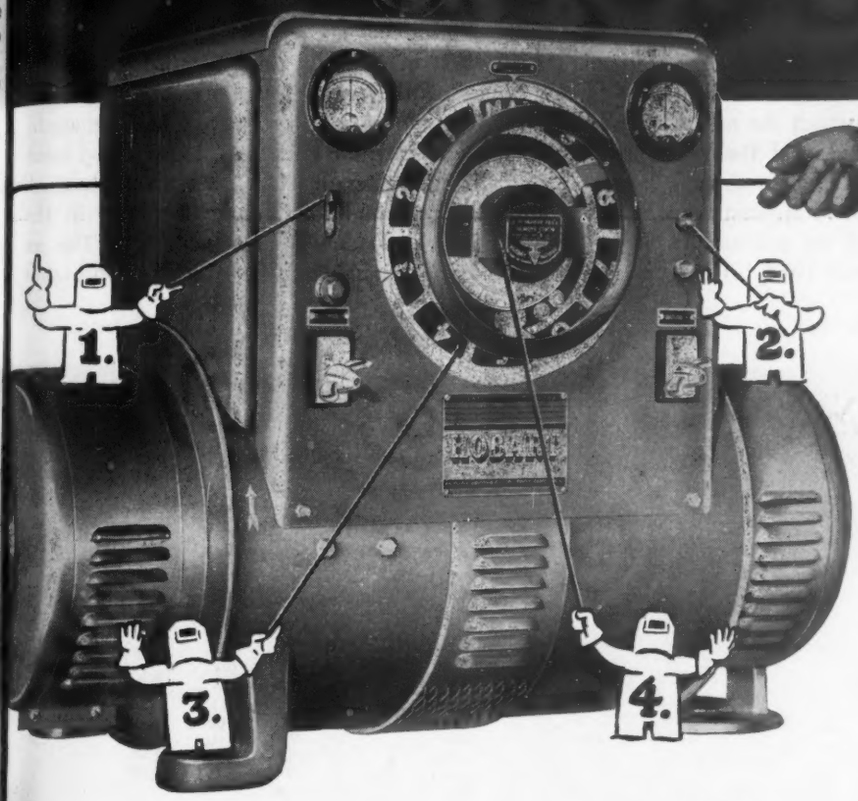
(000 omitted)

Year	Airframes	Engines	Propellers
1941	$ 820,000	$ 496,000	$ 99,000
1942	2,769,000	1,618,000	307,000
1943	6,856,000	2,818,000	626,000
1944, First 3 Quarters	7,808,000	3,049,000	605,000

Source: War Production Board, Bureau of Program & Statistics, Military Division, Aircraft Branch.

Battery of multiple drills in the plant of Boeing Aircraft Co., Seattle. Common work table permits ready transfer of parts from one machine to another

Today's Welding — Calls for HOBART's Kind of Close Control



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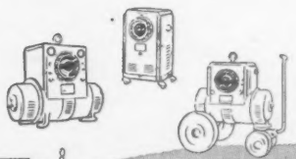

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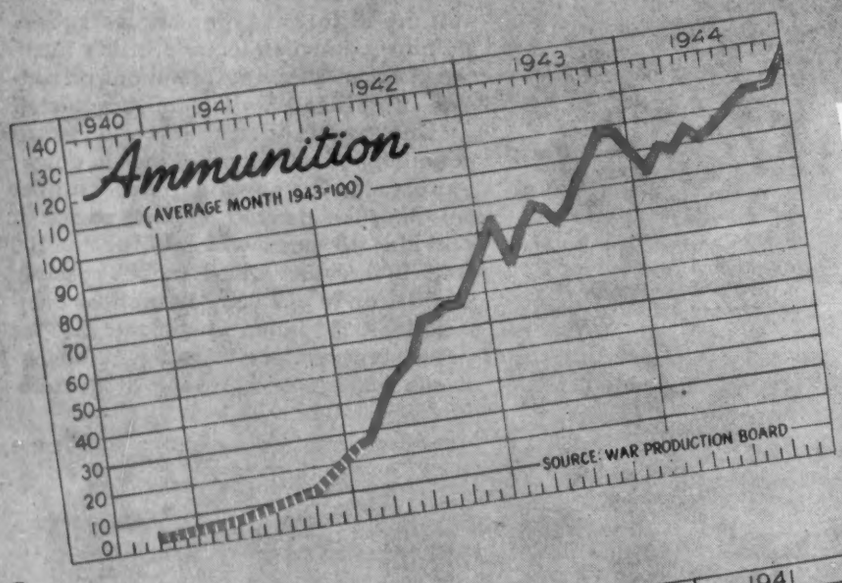
THE BUSINESS TREND

Accent on Lagging Programs as Industry Enters Fourth Year of War

INDUSTRY enters the fourth year of war under pressure of the challenge to bring production in the few critical lagging war programs up to schedules. While the 1944 production record was unexcelled in many categories heavy demands from the military in the closing months of the year forced a revision in plans and deferment of projected reconversion of facilities to peacetime work.

With but few exceptions 1944 witnessed the realization of the war production objectives for which the nation struggled in 1942 and 1943. The first year of the war was one of hasty industrial conversion and organization of emergency controls. The second marked approximate completion of industrial mobilization and the gradual approach to maximum output. The third year, 1944, brought progressive readjustment and consolidation of the war economy, with some decline in total production as certain military requirements were filled, and at least an approach toward reconversion to peacetime work.

Problems of war production will not be solved so long as the war continues. The history of war production has been a constant effort to eliminate bottlenecks. Military needs are always in a state of flux, with battle experiences dictating quick adjustments in requirements of some munitions programs and repeated design revisions in others. The list of critically needed military items in the early stages of the war effort have been replaced by entirely different ones at present, and looking ahead it is possible to discern new ones. As 1944 closed need for 60 and 81-millimeter mortars was re-emphasized, along with mortar ammunition. Huge increases in the use of rockets is a likely development of 1945. The jet propelled plane will probably be in great demand, sim-



	Ammunition				
	1940	1941	1942	1943	1944
Jan.			25	94	102
Feb.			28	78	110
March			38	89	109
April		6	44	97	115
May			49	95	111
June			52	90	113
July			64	96	117
Aug.			65	104	123
Sept.			68	110	125
Oct.	3	11	68	119	125
Nov.			74	118	†126
Dec.			84	110	†137

†Scheduled.

	Aircraft				
	1940	1941	1942	1943	1944
Jan.			27	65	139
Feb.			29	71	140
March			34	81	153
April		9	35	87	140
May			41	95	147
June			44	96	144
July			47	102	141
Aug.			51	110	139
Sept.			54	113	134
Oct.	5	16	55	120	128
Nov.			62	127	†128
Dec.			68	132	†124

†Scheduled.

ilarly other types of airplanes. The Army and Navy have their secret projects, any one of which may yield a critical item in the months to come.

Outstanding among the shifts in war production during the past year has been the increased emphasis on large aircraft such as heavy bombers, including the B-29 Superfortress; also the A-26 Invader and C-54 Skymaster. The combat loader program of today is comparable to the landing craft program of late 1943. Shipbuilding schedules have been modified to permit partial replacement of the mass-produced Liberty ships with faster and more efficient Victory and C-type vessels, partly with a view to postwar use. A huge demand for larger caliber shells, 105-millimeter and up, has developed; and requirements for smaller caliber ammunition have again been revived, in contrast to the scheduled steady decline in output most of last year. A relatively new war requirement is for rockets.

Programs that currently are behind schedule include: Heavy bombers, extra large ammunition and artillery,

CHARTS
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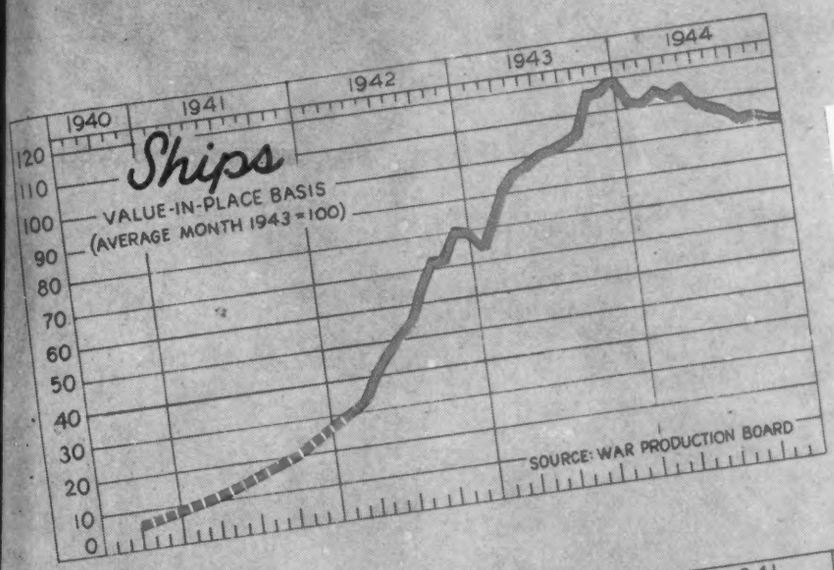
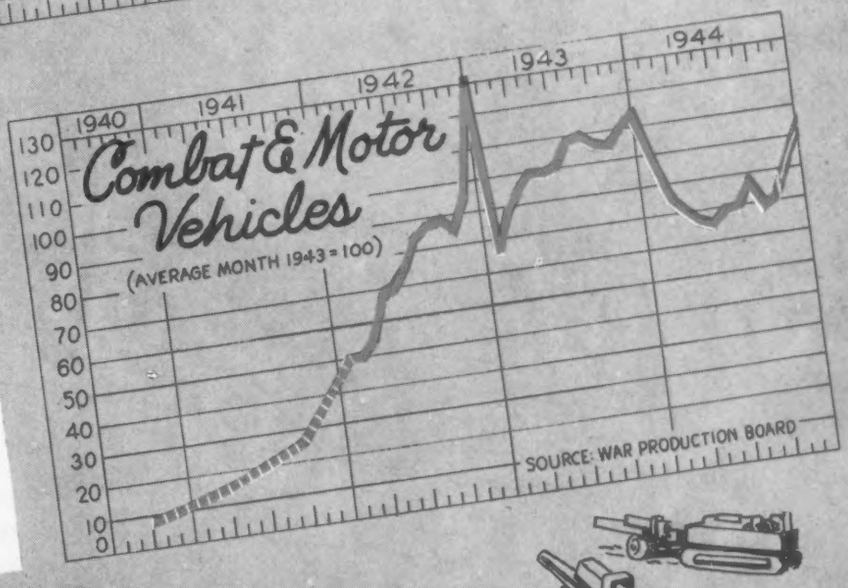


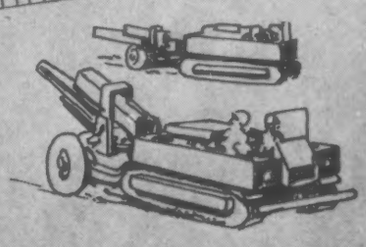
	Ships* 1940	1941	1942	1943	1944
Jan.			28	74	112
Feb.			31	83	110
March			34	92	114
April		11	41	95	111
May			47	97	114
June			51	100	109
July			54	101	107
Aug.			64	102	105
Sept.			72	104	102
Oct.	6	19	72	116	103
Nov.			80	116	†102
Dec.			79	120	†101

*Value-in-place basis. †Scheduled.



	Combat and Motor Vehicles 1940	1941	1942	1943	1944
Jan.			50	77	98
Feb.			50	88	83
March			53	93	80
April		15	67	98	76
May			69	100	75
June			75	108	78
July			84	109	79
Aug.			87	105	85
Sept.			88	104	82
Oct.	8	28	84	109	†92
Nov.			93	113	†101
Dec.			129		

†Scheduled.

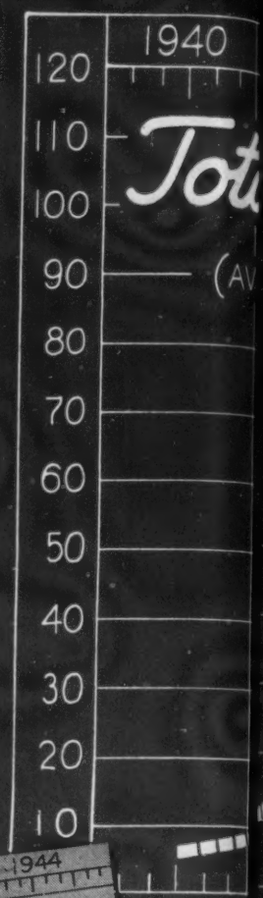


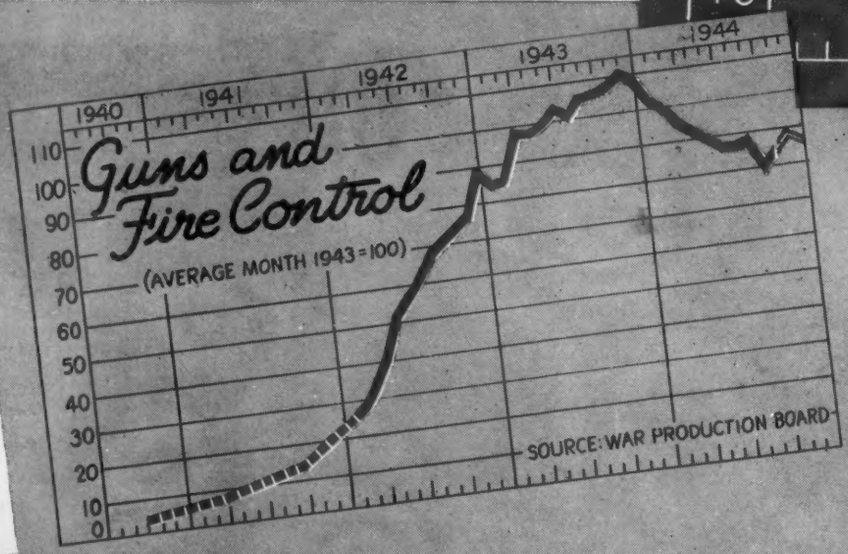
heavy trucks and tires, assault transports and assault cargo ships, and radar equipment.

Wartime experience has demonstrated the enormous potential productivity of American industry. Economists warn that war stimulated production records should not be permitted to lull us into forgetting the experience of the nineteen-thirties. In 1939, the last year prior to the intensive rearmament program, the national income was 15 per cent smaller than it had been ten years earlier and less than half the estimated figure for last year. Millions of persons were seeking work in that year despite the fact billions of dollars had been borrowed and spent by the government in an effort to increase production and provide employment.

During the transition period the economic forces shaping the course of business will be immensely powerful. Shrinkage in war expenditures will constitute the greatest decrease in purchasing demand that any nation has ever experienced. The number of persons seeking new jobs, will also be of record breaking proportions. Unprecedented demand for civilian goods, plus large accumulated money savings of individuals, will be the chief cushioning factors to a business lull.

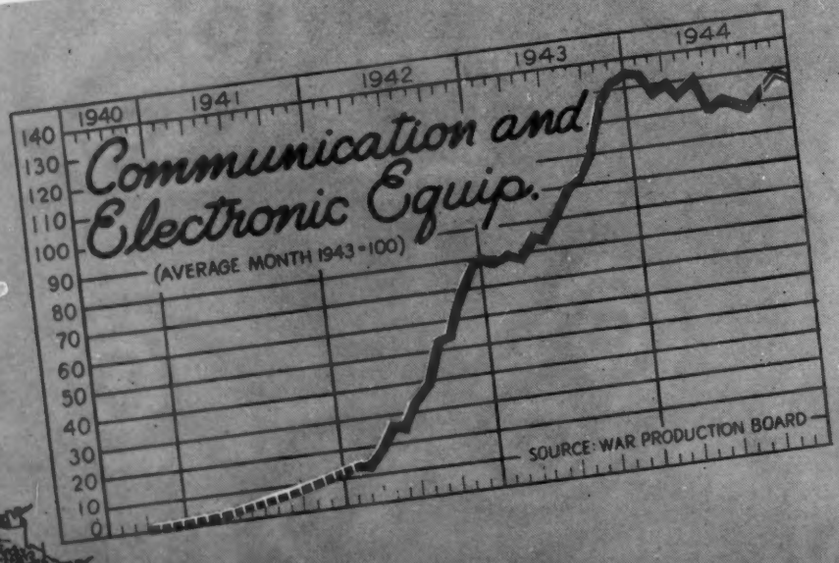
Economic transition from war to peace will not be effected with perfect smoothness. But the attitude of the national administration toward private enterprise through encouragement of "risk" capital by removing numerous regulations and controls, will to a large extent determine the degree to which full employment can be achieved in the postwar era.





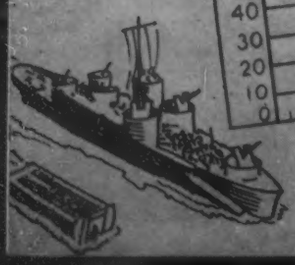
Guns and Fire Control	1940	1941	1942	1943	1944
Jan.	..		25	84	102
Feb.	..		29	85	100
March	..	7	34	97	95
April	..		42	97	91
May	..		52	99	89
June	..		57	102	85
July			62	100	85
Aug.			68	105	87
Sept.			71	106	80
Oct.	4	14	74	107	†88
Nov.			77	110	†87
Dec.			88	108	

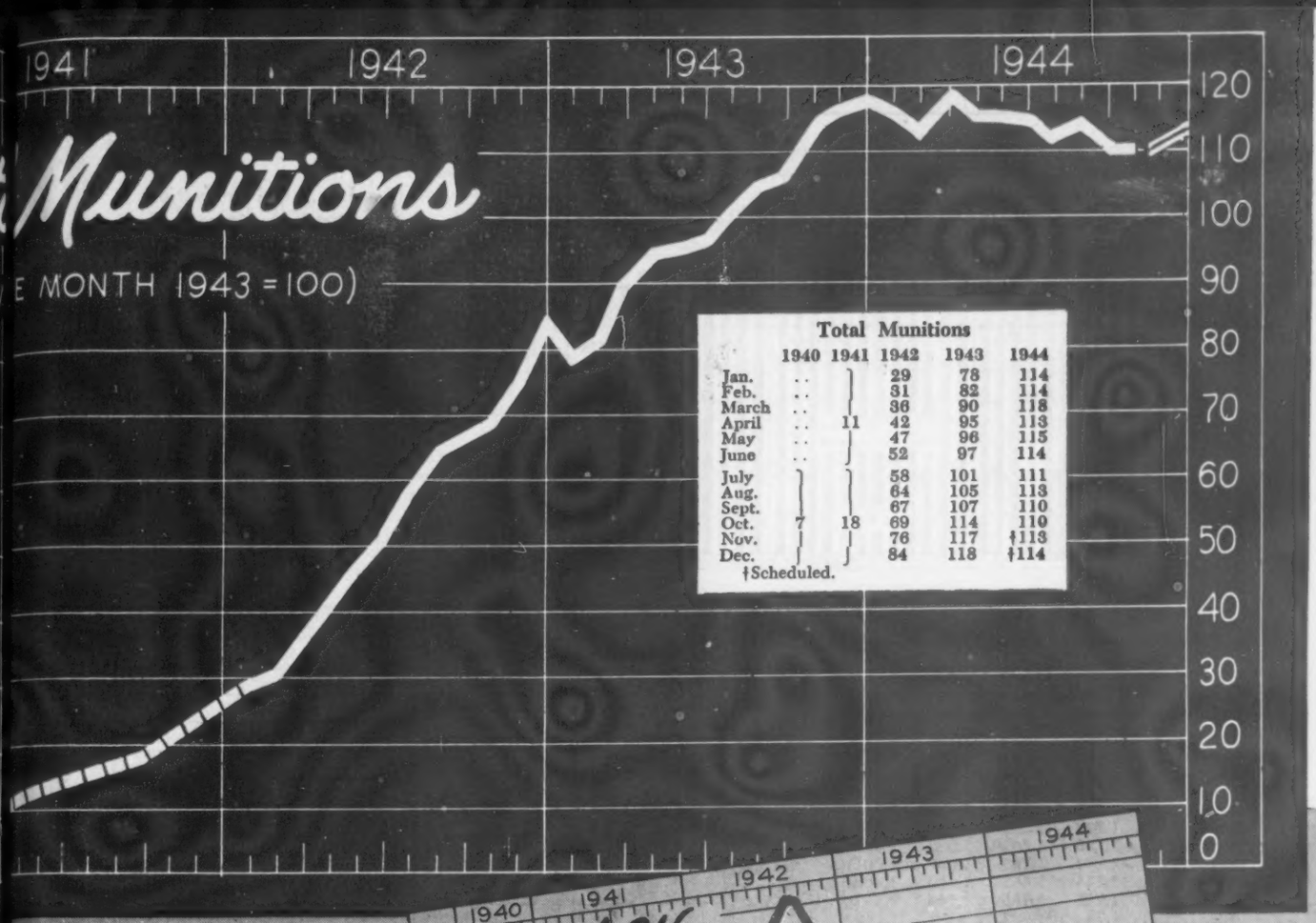
†Scheduled.



Communications and Electronics	1940	1941	1942	1943	1944
Jan.	..		14	78	134
Feb.	..		14	80	127
March	..	4	18	79	129
April	..		27	85	124
May	..		26	83	125
June	..		33	90	128
July			39	99	117
Aug.			53	102	119
Sept.			54	110	119
Oct.	2	9	68	126	124
Nov.			78	132	†129
Dec.			80	135	†127

†Scheduled.

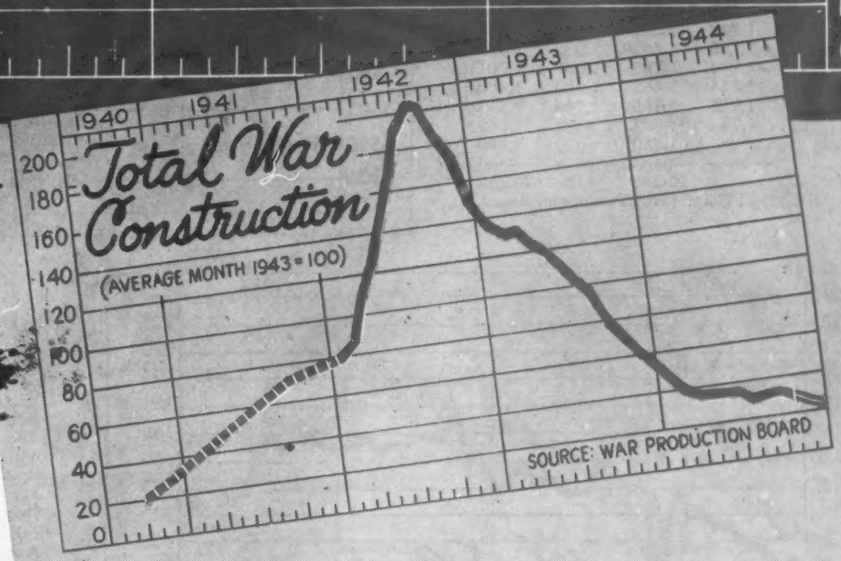




Total Munitions

	1940	1941	1942	1943	1944
Jan.	..		29	78	114
Feb.	..		31	82	114
March	..		36	90	118
April	..	11	42	95	113
May	..		47	96	115
June	..		52	97	114
July			58	101	111
Aug.			64	105	113
Sept.			67	107	110
Oct.	7	18	69	114	110
Nov.			76	117	†113
Dec.			84	118	†114

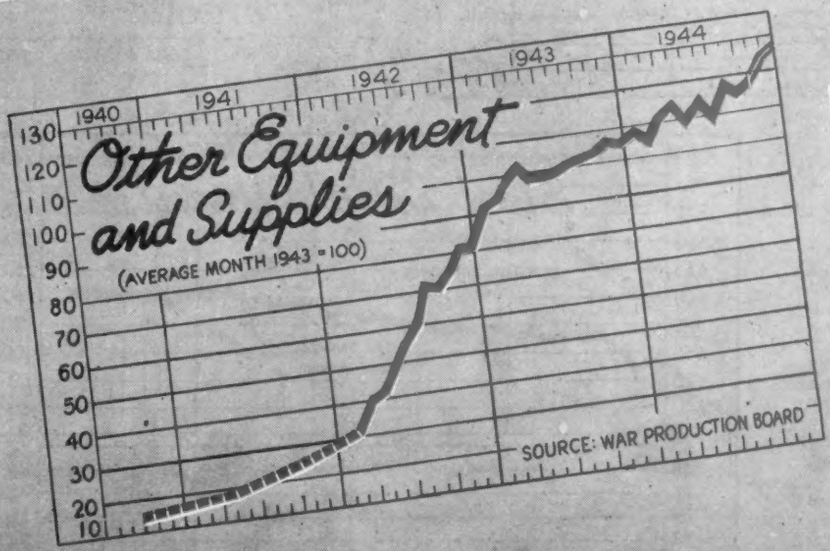
†Scheduled.



Total War Construction*

	1940	1941	1942	1943	1944
Jan.	..		79	134	45
Feb.	..		86	130	39
March	..		108	131	36
April	..	45	125	122	36
May	..		145	118	36
June	..		168	110	35
July			193	100	31
Aug.			203	94	34
Sept.			201	78	31
Oct.	19	71	182	70	30
Nov.			171	60	†26
Dec.			145	53	†23

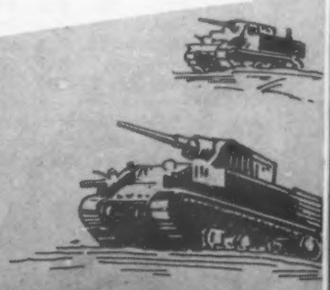
*Government financed. †Scheduled.

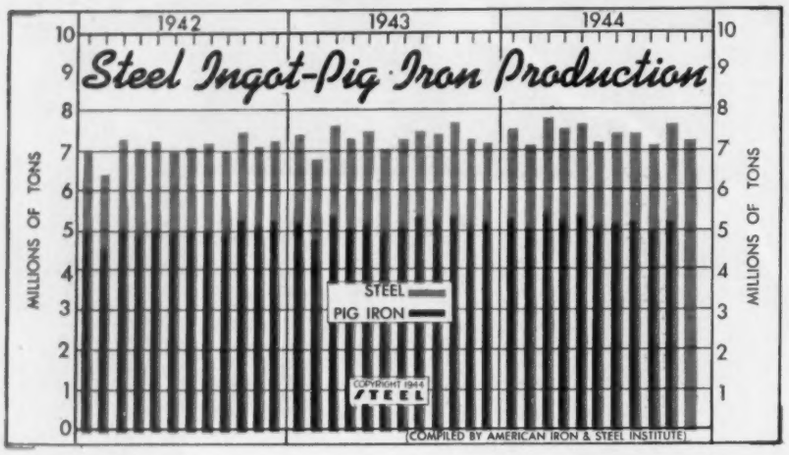


Other Equipment and Supplies

	1940	1941	1942	1943	1944
Jan.	..		29	91	107
Feb.	..		32	93	103
March	..	17	39	98	110
April	..		41	103	113
May	..		48	98	108
June	..		54	98	114
July			60	99	107
Aug.			71	102	115
Sept.			70	103	118
Oct.	14	23	74	104	119
Nov.			81	106	†125
Dec.			81	105	†126

†Scheduled.





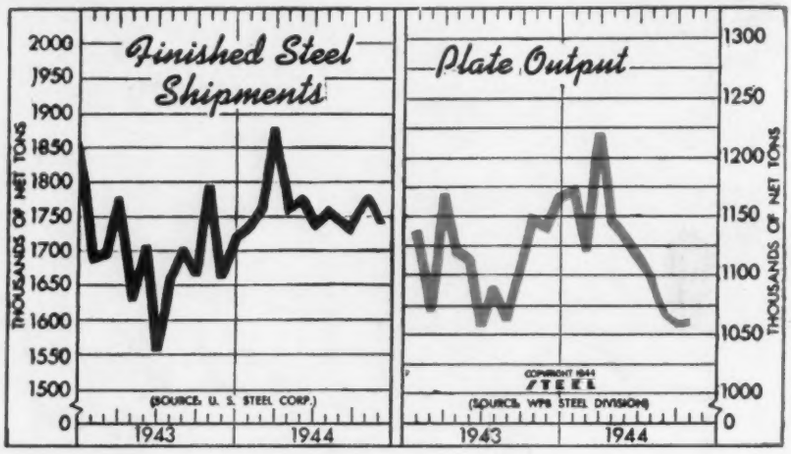
Iron, Steel Production
(Net tons—000 omitted)

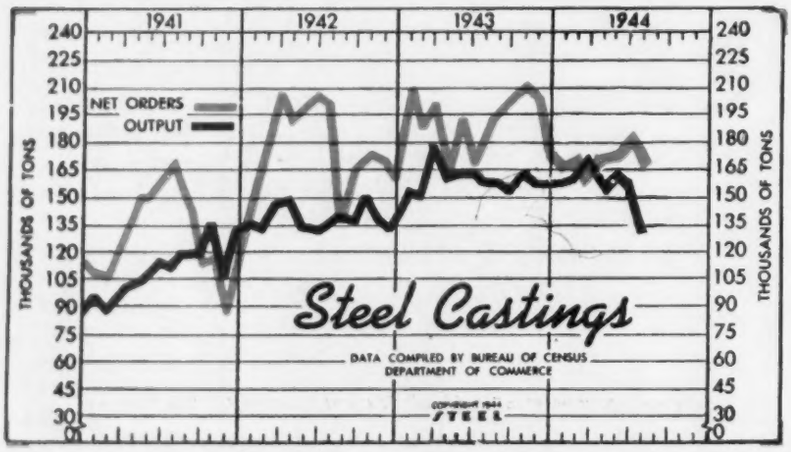
	Steel Ingots		Pig Iron	
	1944	1943	1944	1943
Jan.	7,587	7,425	5,276	5,194
Feb.	7,189	6,825	5,026	4,766
Mar.	7,820	7,675	5,434	5,314
Apr.	7,588	7,374	5,243	5,033
May	7,696	7,550	5,343	5,173
June	7,228	7,039	5,057	4,836
July	7,493	7,408	5,157	5,023
Aug.	7,493	7,586	5,210	5,316
Sept.	7,230	7,514	4,988	5,226
Oct.	7,616	7,814	5,200	5,324
Nov.	7,259	7,374	....	5,096
Dec.	....	7,266	....	5,213
Total	....	88,873	....	61,777

Steel Shipments†—Plate Production‡
(Net tons; 000 omitted)

	Shipments		Plate Output	
	1944	1943	1944	1943
Jan.	1,731	1,686	1,173	1,135
Feb.	1,756	1,692	1,122	1,072
Mar.	1,875	1,772	1,223	1,168
Apr.	1,757	1,631	1,142	1,122
May	1,777	1,707	1,132	1,115
June	1,738	1,553	1,112	1,056
July	1,755	1,661	1,093	1,090
Aug.	1,743	1,705	1,067	1,061
Sept.	1,734	1,665	1,060	1,106
Oct.	1,775	1,795	1,064	1,147
Nov.	1,744	1,661	....	1,142
Dec.	....	1,720	....	1,169
Total	....	20,245	....	13,382

†U. S. Steel Corp. ‡War Production Board.





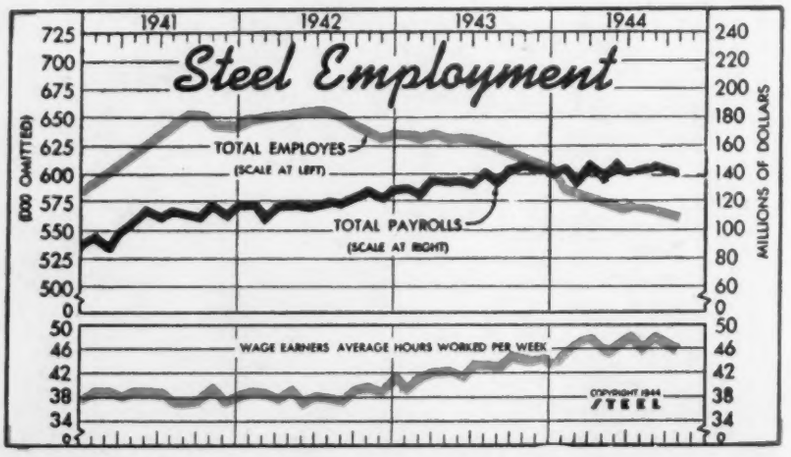
Commercial Steel Castings
(Net tons in thousands)

	Orders		Production	
	1944	1943	1944	1943
Jan.	167.7	213.1	159.8	154.7
Feb.	173.6	191.2	161.4	151.5
Mar.	162.6	202.7	174.6	176.5
Apr.	175.1	165.8	155.8	161.4
May	177.0	192.5	161.8	163.8
June	181.8	171.8	157.4	163.9
July	169.9	187.3	131.9	158.8
Aug.	....	200.6	....	158.8
Sept.	....	214.1	....	157.8
Oct.	....	211.3	....	163.9
Nov.	....	209.3	....	158.8
Dec.	....	173.6	....	158.6
Total	....	2,333.4	....	1,928.6

Steel Employment

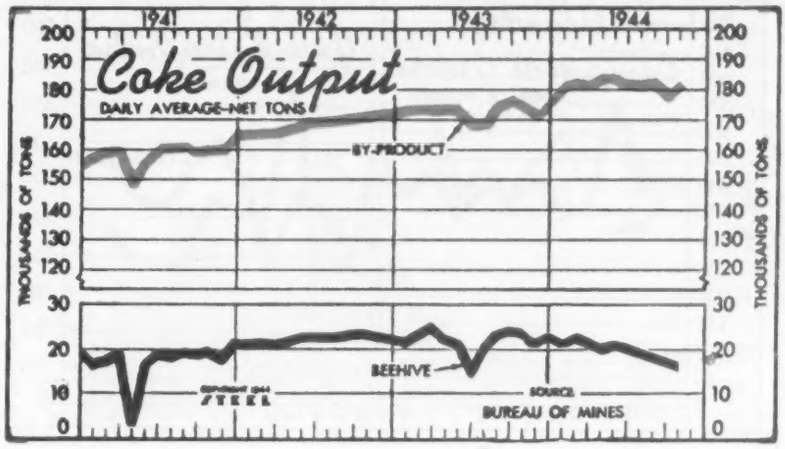
	Employes (000 omitted)			Total Payrolls (Unit—$1,000,000)		
	1944†	1943	1942	1944	1943	1942
Jan.	583	637	651	$141.8	$129.7	$118.8
Feb.	583	635	651	137.6	122.8	108.5
March	578	637	653	145.3	136.8	117.0
April	573	634	654	138.9	133.3	118.5
May	569	632	656	145.4	137.4	117.4
June	570	631	659	140.5	136.2	118.0
July	571	627	655	141.7	142.8	120.7
Aug.	569	625	647	143.9	139.9	118.7
Sept.	565	620	641	142.2	143.8	124.8
Oct.	564	615	635	141.7	144.9	126.6
Nov.	...	611	632	.....	141.5	122.8
Dec.	...	605	633	.....	140.2	129.3

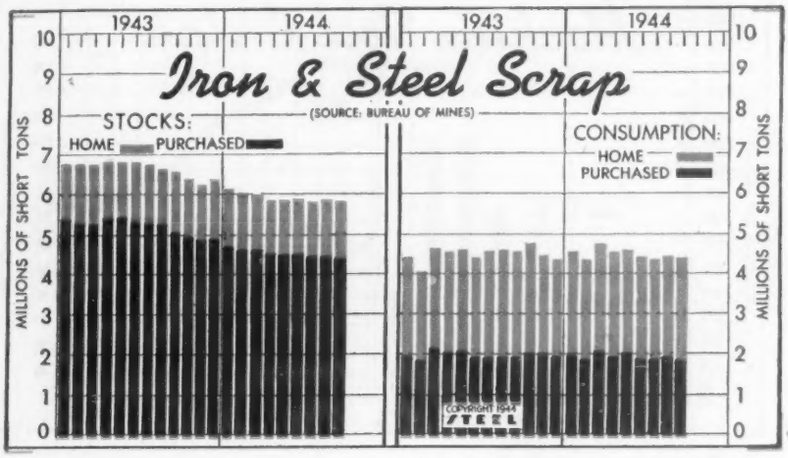
†Monthly average; previous reports showed total number regardless of whether they worked one day or full month.



Coke Output
Bureau of Mines
(Daily Average—Net Tons)

	By-Product 1944	By-Product 1943	Beehive 1944	Beehive 1943
Jan.	182,226	174,044	21,933	21,440
Feb.	184,384	175,099	22,248	23,987
Mar.	183,123	175,051	21,529	24,369
Apr.	185,259	175,857	20,457	22,948
May	184,071	174,400	20,783	21,200
June	181,891	168,900	20,472	14,000
July	181,506	169,936	19,531	20,009
Aug.	181,718	176,396	18,516	23,102
Sept.	179,234	178,300	17,204	23,700
Oct.	181,772	175,700	16,957	23,600
Nov.	.....	171,594	.....	20,421
Dec.	.....	179,042	.....	22,935
Average	.....	174,465	.....	21,795



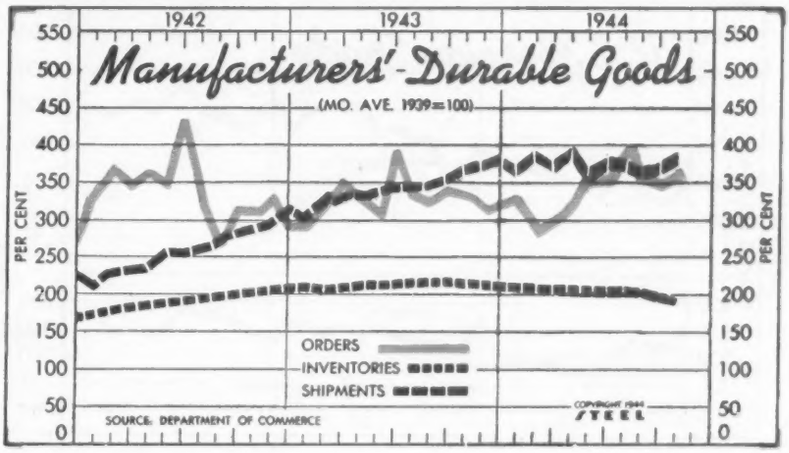


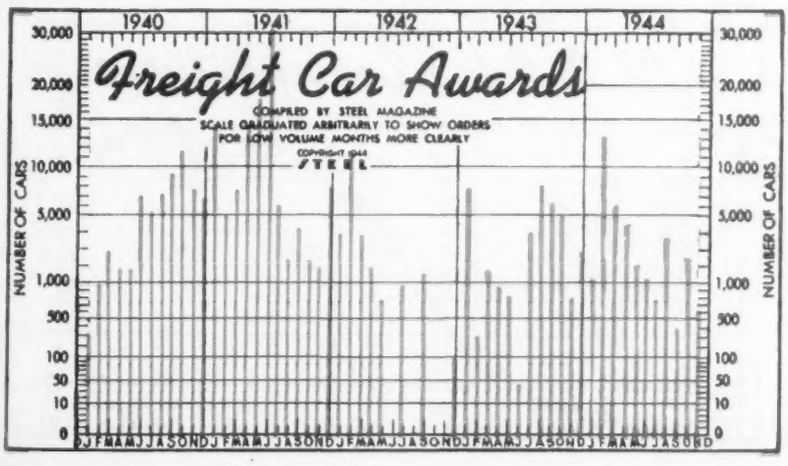
Iron and Steel Scrap
Bureau of Mines
(Gross Tons—000 omitted)

	Consumers' Stocks 1944	Consumers' Stocks 1943	Total Consumption 1944	Total Consumption 1943
Jan.	6,214	6,877	4,616	4,492
Feb.	6,134	6,871	4,414	4,178
Mar.	6,027	6,850	4,827	4,787
Apr.	5,932	6,918	4,629	4,642
May	5,966	6,905	4,683	4,723
June	5,991	6,916	4,460	4,493
July	5,909	6,860	4,423	4,670
Aug.	5,976	6,778	4,533	4,696
Sept.	5,953	6,613	4,471	4,637
Oct.	....	6,456	....	4,830
Nov.	....	6,391	....	4,581
Dec.	....	6,448	....	4,449
Mo.Ave.	....	6,740	....	4,599

Index of Manufacturers Durable Goods

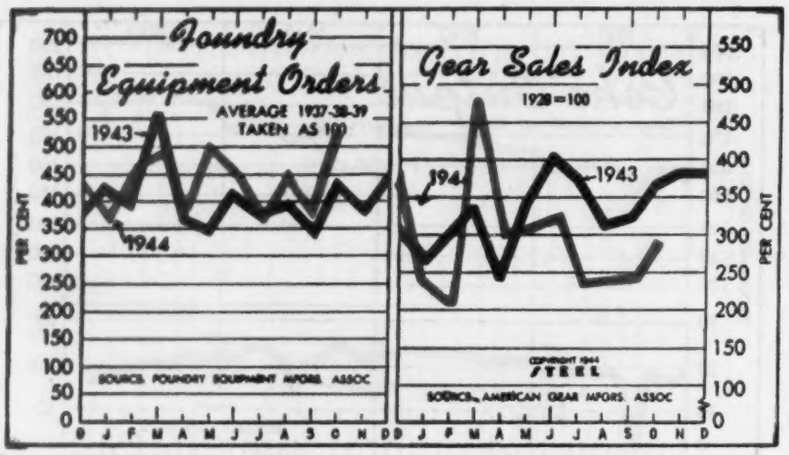
	Orders 1944	Orders 1943	Shipments 1944	Shipments 1943	Inventories 1944	Inventories 1943
Jan.	331.5	293.5	365	208	212.0	211.3
Feb.	294.4	326.6	384	337	208.6	209.6
Mar.	309.7	349.2	369	330	207.2	210.7
Apr.	325.0	329.8	387	338	204.9	213.5
May	351.6	313.0	369	338	204.0	213.5
June	358.9	392.7	378	343	203.8	212.5
July	392.7	338.7	375	346	201.9	211.4
Aug.	366.9	319.4	368	354	200.9	213.4
Sept.	350.0	339.5	370	356	198.8	214.9
Oct.	371.0	339.5	387	371	196.1	214.0
Nov.	....	316.1	...	373	....	213.3
Dec.	....	324.2	...	380	....	212.8
Ave.	...	332.3	...	339	....	212.7




Freight Car Awards
COMPILED BY STEEL MAGAZINE
SCALE GRADUATED ARBITRARILY TO SHOW ORDERS FOR LOW VOLUME MONTHS MORE CLEARLY
COPYRIGHT 1944 STEEL
NUMBER OF CARS

Freight Car Awards

	1944	1943	1942	1941
Jan.	1,020	8,365	4,253	15,169
Feb.	13,240	350	11,725	5,508
March	6,510	1,935	4,080	8,074
April	4,519	1,000	2,125	14,645
May	1,952	870	822	18,630
June	1,150	50	0	32,749
July	795	4,190	1,025	6,459
Aug.	3,900	8,747	0	2,668
Sept.	400	6,820	1,863	4,470
Oct.	2,425	5,258	0	2,499
Nov.	605	870	0	2,222
Dec.	.....	2,919	135	8,406
Total	.....	41,374	26,028	121,499



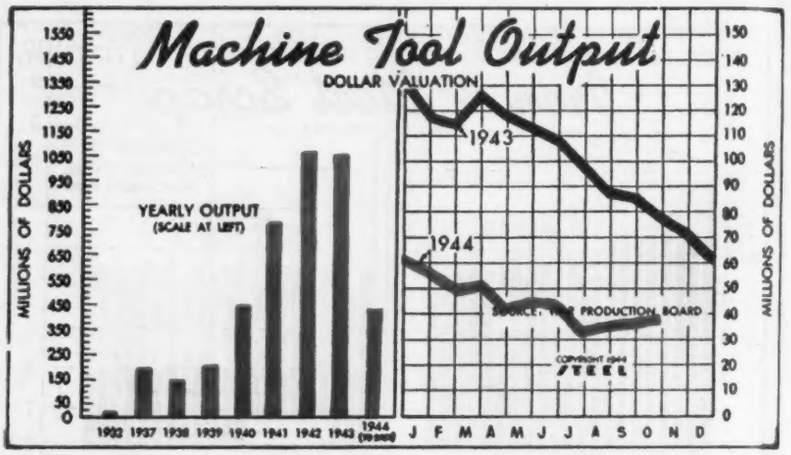
Foundry Equipment and Gear Sales

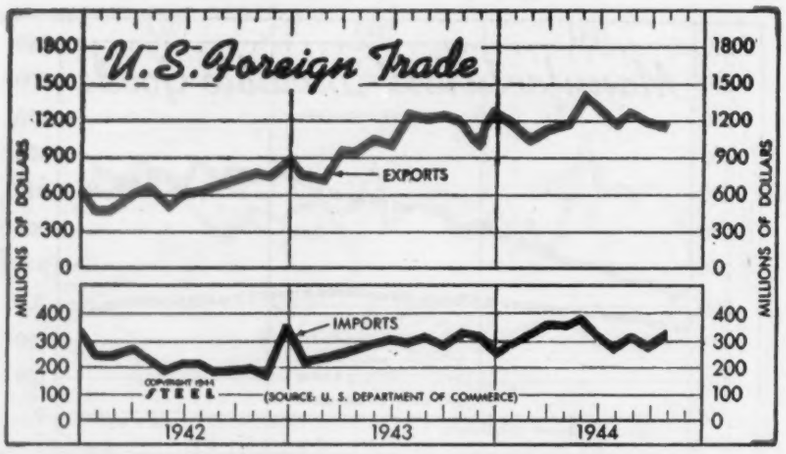
	Monthly Average (1937-38-39=100)			Index (1928=100)		
	1944	1943	1942	1944	1943	1942
Jan.	378.3	429.8	532.7	246	268	288
Feb.	456.8	399.5	567.9	214	303	353
Mar.	498.4	562.7	1122.4	485	334	455
Apr.	385.7	362.7	1089.3	308	240	378
May	503.9	348.9	653.6	305	342	421
June	466.1	413.6	774.0	328	401	378
July	375.8	379.4	800.8	242	374	344
Aug.	450.5	390.4	510.8	247	312	380
Sept.	388.0	346.6	446.4	248	320	351
Oct.	526.5	436.6	540.6	293	368	268
Nov.	....	388.0	338.8	...	387	359
Dec.	....	442.8	382.5	...	387	300
Avg.	....	440.3	646.7	...	336	355

Machine Tool Output
(000 omitted)

	1944	1943	1942
Jan.	$56,363	$117,384	$ 83,547
Feb.	50,127	114,594	84,432
Mar.	51,907	125,445	98,358
Apr.	41,370	118,024	103,364
May	41,819	113,859	107,297
June	41,471	108,736	111,090
July	33,916	97,541	113,596
Aug.	35,041	87,827	117,342
Sept.	35,876	85,842	119,883
Oct.	37,100	78,300	130,008
Nov.	.....	71,811	120,871
Dec.	.....	60,861	131,960

Year	
1942	1,321,862
1941	812,462
1940	450,000
1939	210,000



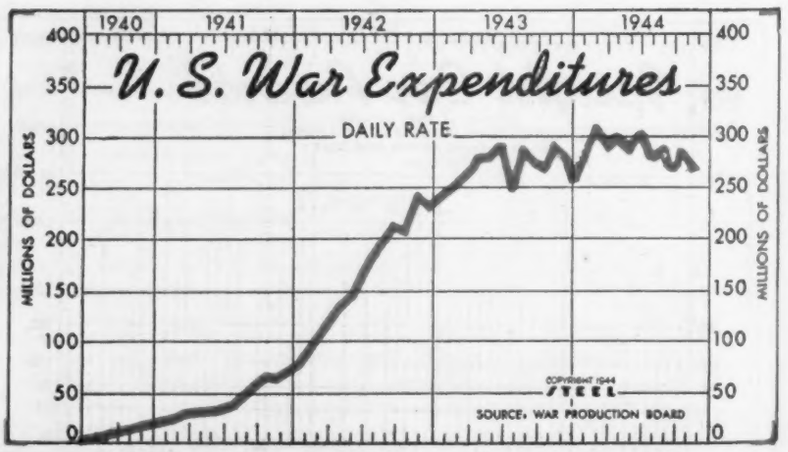


Foreign Trade
Bureau of Foreign and Domestic Commerce
(Unit Value—$1,000,000)

	Exports			Imports		
	1944	1943	1942	1944	1943	1942
Jan.	1,192	730	481	300	228	254
Feb.	1,086	719	480	313	234	254
Mar.	1,158	988	628	359	249	272
Apr.	1,182	980	717	359	258	235
May	1,419	1,085	535	386	281	191
June	1,271	1,002	648	330	295	215
July	1,198	1,262	650	293	300	213
Aug.	1,207	1,204	706	302	315	186
Sept.	1,199	1,235	732	280	286	196
Oct.	1,138	1,195	802	327	329	200
Nov.	....	1,074	787	...	317	168
Dec.	....	1,241	873	...	278	358
Total	....	12,716	8,035	...	3,369	2,742

War Expenditures
(millions)

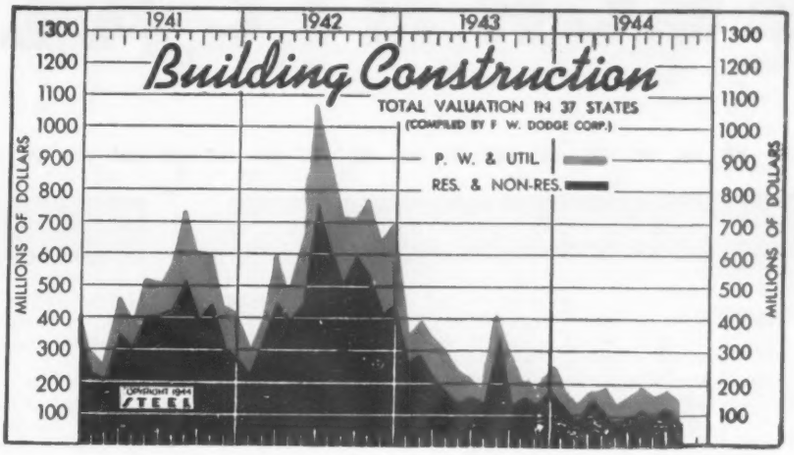
	1944 Monthly Expenditures	1944 Daily Rate	1943 Monthly Expenditures	1943 Daily Rate
Jan.	$7,416	$285.2	$6,254	$240.5
Feb.	7,808	312.3	6,081	253.4
Mar.	7,948	294.4	7,112	263.4
Apr.	7,493	299.7	7,290	280.4
May	7,918	293.3	7,373	283.6
June	7,957	306.0	7,688	295.7
July	7,355	282.9	6,746	249.9
Aug.	7,798	288.8	7,529	289.6
Sept.	7,104	273.2	7,212	277.4
Oct.	7,447	286.4	7,105	273.3
Nov.	7,095	272.9	7,794	299.8
Dec.	....	....	6,951	267.3
Total	Av....	Tt'l.	85,135	Av. 272.9

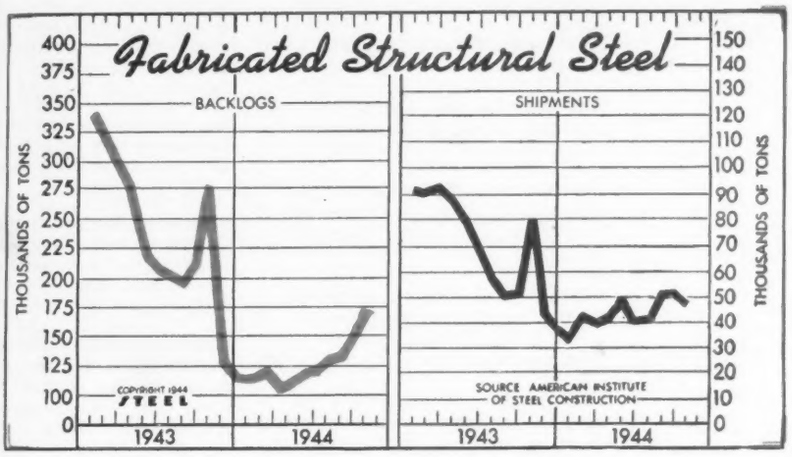


Construction Valuation In 37 States

(Unit—$1,000,000)

	Total	Public Works-Utilities 1944	Public Works-Utilities 1943	Residential-Non-Res. 1944	Residential-Non-Res. 1943
Jan.	159.2	50.3	85.8	108.9	264.3
Feb.	137.2	55.1	112.9	82.1	280.5
Mar.	176.4	61.3	123.0	115.1	216.7
April	179.3	72.0	127.7	107.3	175.6
May	144.2	55.8	95.8	88.4	138.6
June	163.9	70.7	73.3	93.1	156.8
July	190.5	80.5	50.0	110.0	133.7
Aug.	169.3	69.4	73.4	99.9	340.8
Sept.	175.7	64.1	175.1	111.6	125.0
Oct.	144.8	52.2	63.5	92.6	150.0
Nov.	....	...	59.0	....	125.4
Dec.	....	...	67.4	....	184.9
Total	....	...	1,106.9	....	2,106.4





Fabricated Structural Steel

(1000 tons)

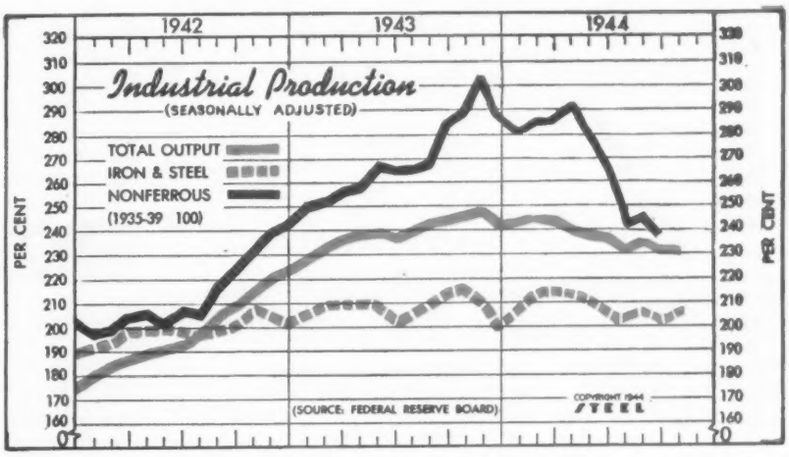
	Shipments 1944	Shipments 1943	Shipments 1942	Backlogs 1944	Backlogs 1943	Backlogs 1942
Jan.	34.0	91.9	167.8	113.1	339.1	704.4
Feb.	41.7	90.8	164.6	117.6	321.0	706.7
Mar.	40.1	94.0	191.3	106.3	299.8	777.7
Apr.	42.2	86.6	187.2	111.2	272.5	772.4
May	48.0	78.9	184.2	116.3	220.6	843.8
June	40.1	68.4	182.7	122.7	207.1	869.8
July	40.3	56.8	189.9	125.4	201.8	808.6
Aug.	51.2	50.2	173.9	130.4	195.6	783.5
Sept.	51.5	51.8	169.8	151.1	208.1	716.0
Oct.	48.5	80.1	152.9	174.4	274.0	617.7
Nov.	...	42.7	130.4	....	134.6	566.6
Dec.	...	39.6	145.3	....	113.0	523.5

Source: American Institute of Steel Construction. Figures for 1943 to date cover members' reports only; for other years they are estimates for the entire industry.

Federal Reserve Board's Production Indices

(1935-1939 = 100)

	Total Production 1944	Total Production 1943	Iron, Steel 1944	Iron, Steel 1943	Nonferrous 1944	Nonferrous 1943
Jan.	242	227	208	204	281	250
Feb.	244	232	212	208	285	252
Mar.	242	235	214	210	286	256
Apr.	239	237	213	209	292	257
May	237	238	210	208	279	266
June	235	236	204	201	264	264
July	231	240	202	204	243	256
Aug.	232	242	203	210	245	264
Sept.	231	244	202	214	239	277
Oct.	230	247	205	215	...	286
Nov.	...	247	...	209	...	304
Dec.	...	241	...	200	...	286
Avg.	...	239	...	207	...	270



Federal Reserve Board's Production Index

(1935-39 average = 100)

	1944	1943	1942	1941	1940	1939	1938	1937	1936	1935	1934	1933	1932	1931	1930	1929	1928	1927	1926
Jan.	242	227	181	140	122	101	85	116	94	83	72	58	65	78	100	108	95	97	93
Feb.	244	232	183	144	116	101	84	118	92	85	75	57	63	79	100	108	95	97	94
Mar.	242	235	186	147	113	101	84	120	93	84	79	54	62	81	98	109	96	99	95
Apr.	239	237	189	144	112	98	82	120	98	82	80	58	58	80	98	110	96	96	94
May	237	239	191	154	116	98	81	121	100	83	80	68	56	80	96	112	97	97	94
June	235	236	193	159	122	103	81	119	103	84	79	78	54	78	93	114	98	97	95
July	231	240	197	160	122	105	86	120	104	84	73	86	53	76	89	114	99	95	95
Aug.	232	242	204	160	124	105	90	119	106	87	72	82	54	74	87	114	101	95	97
Sept.	231	244	208	161	127	114	93	115	108	89	70	77	58	70	85	113	102	94	98
Oct.	230	247	215	163	130	121	96	107	110	92	71	73	60	68	83	110	104	92	98
Nov.	...	247	220	166	134	124	100	96	113	94	72	69	60	67	81	105	106	92	97
Dec.	...	241	223	167	139	125	101	87	116	95	77	70	58	66	79	100	107	93	97
Avg.	...	239	199	155	123	108	89	113	103	87	75	69	58	75	91	110	99	95	96

TECHNICAL WORK

STATUS AS OF

IRON AND STEEL PRODUCTION

BLAST FURNACE PRACTICE

Eastern blast furnaces may eventually swing to use of egg-size anthracite (p. 256)

Co-ordination of blast furnace charging more important than speeding up charging mechanisms (p. 257)

Operation of new blast furnace under pressure cuts down flue dust (p. 258)

More attention being given blast furnace insulation (p. 257)

Judicious addition of steam to charge achieves excellent results (p. 257)

Steelmaker finds North Carolina sponge iron compares favorably with Swedish product (p. 258)

Uniformly blended ores provide smoother blast furnace operation (p. 257)

STEELMAKING PRACTICE

Closer control over open hearth melting reactions aids higher alloy recovery (p. 262)

New immersion-type pyrometer provides better temperature control over molten steel (p. 260)

No need to fear alloy contamination of steel (p. 262)

Postwar use of air preheaters may reduce fuel consumption and increase furnace productive capacity (p. 258)

Proper location of maximum flame temperatures in open hearths facilitated by flame study procedure (p. 262)

Rimmed and semikilled steels "half-made" and will be replaced by non-age-hardening types (p. 258)

Improved open hearth practice obtained by charging carbon in form of graphite and petroleum coke with 100 per cent scrap (p. 262)

Chemical effects of furnaces gasses on steel when heated being studied (p. 260)

Better heats possible through control over pit practice (p. 260)

ROLLING MILL PRACTICE

Higher rolling speeds ahead along with more automatic operation (p. 264)

New, killed drawing-quality steel adapted for deep-drawing jobs (p. 262)

Enameling sheet, just developed, requires no ground coat (p. 262)

Twin motors drive new 4-high plate mill, eliminating pinions (p. 264)

Temper mill with speed of 6000 f.p.m. contemplated (p. 264)

WIREMAKING

Continuous electric resistance strand patenting, annealing 90 per cent efficient (p. 264)

Stainless wire producers hope necessary increase in facilities will be justified by enlarged postwar market (p. 264)

Buying steel on performance not new to wiremakers who customarily "tailor" to individual requirements (p. 268)

Lighter, stronger ropes and cords for airplane controls are current objective (p. 268)

COLD DRAWING

Sintered carbide dies provide better finish (p. 268)

FUEL

May add coal-washing machines to improve coke quality (p. 374)

REFRACTORIES

Cold ramming magnesia refractory for furnace construction and repairs reduces installation time (p. 372)

Two completely basic furnaces to be lighted this year will help evaluate advantages of construction (p. 374)

New silica mortars of high refractoriness and workability are finding extended use (p. 372)

High-magnesia ramming mixtures for open hearth furnaces brought up to final contours without further dressing (p. 372)

LUBRICATION

Lubrication engineers look for improved lubricants with better resistance to oxidation, foaming and corrosion (p. 300)

Additives in lubricants aid petroleum technologists to keep pace with machine designers (p. 300)

Greatest improvement born of war is accelerated installation of centralized grease systems (p. 300)

METALLURGY

Hardenability bands will continue to promote better understanding of steel specifications (p. 274)

Increased need for structural uses of magnesium is imposing (p. 376)

Anticorrosive properties of silver encourage utilization in steel cladding for high-pressure equipment (p. 378)

Research will yield further valuable data on role of molybdenum in hardening process (p. 275)

Aluminum-tin composition being widely tested for internal combustion engine bearings (p. 378)

Further developments can be expected from controlled use of strain (cold-working) relative to heat treatment (p. 275)

Hardenability specifications for steel more likely to be added to than substituted for chemical requirements (p. 274)

Boron is finding successful applications in ferrous and nonferrous metallurgy unknown a year ago (p. 277)

Many new-found uses for nickel and high nickel alloys still "under wraps" argue strongly for postwar expression of the engineering utility (p. 378)

Parts formerly made of carbo steel being redesigned to tak advantage of higher strengt provided by steels utilizing sma alloy additions (p. 274)

New instrument will indica degree of magnetization (ma netic particle inspection) at an point on the surface of a cas ing under test (p. 378)

Marked trend noted toward placement of costly high allo with induction hardened carbo steels (p. 275)

High hardness and low order stresses hitherto unattained be developed simultaneously tomorrow's method of molte bath quenching (p. 297)

Low-temperature notched im pact tests accredited in dete mining ability of steel to with stand constraint at normal tem peratures (p. 378)

High-purity magnesium alloy with high-corrosion resistanc an important development (p 378)

Superabundance of alloy scra will tax metallurgists to gai uniformity in chemical an physical makeup of steels (p 277)

POWDER METALLURGY

Importance of some powders used in electronics, X-ray and electrical field makes price no object (p. 278)

Hot pressed alloy steels may become available this year (p. 380)

Molding and sintering of soft, magnetic parts of complicate shapes for direct-current appli cations is significant (p. 278)

Interest grows in diffusion alloy ing of element metal powder into alloys during sinterin (p. 278)

JOINING AND WELDING

Trained welding engineer to be continually in demand (p. 384)

Hydrofluosilicic acid effectively removes surface oxide in preparation for spotwelding (p. 290)

Solution to behavior of materials under triaxial stresses to help solve design problems (p. 384)

Use of steam at 1400 per square inch (935 degrees Fahr.) facilitated by suitable welding procedure (p. 290)

Welding, soldering, brazing,rosin bonding may merge into broad overall engineering classifica tion (p. 384)

Resistance-welding of heavier gage materials in limelight (p 290)

Centralized control system be answer to advancing demands o production welding (p. 384)

New electrodes for higher tensil steels require no preheatin (p. 290)

Trend toward durable, close tolerance fasteners enhances pos sibilities for more intricat commercial assemblies (p. 384

SHEET FOR 1945

ANUARY 1, 1945

CASTING

GRAY IRON

manent mold process for gray castings delivers high-ngth, dense structure and machining characteristics 271)

ilability of inoculants to ease blems of metallurgical control uniformity of product 271)

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NONFERROUS

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pansion of duplexing process gest development in malleable in 1944 (p. 270)

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STEEL

ter quenching extended to y types of steel castings ing past year (p. 388)

ltiple lots of small castings possess "unheard of accuracy and appearance" owing to investment method (p. 388)

Control tools used in conjunction with liquid quenching are proving invaluable (p. 388)

CENTRIFUGAL

Centrifugal casting of cylinder sleeves and liners receives serious consideration and experimentation (p. 271)

Wartime exigencies place "lost wax" technique—with additional pressure to force metal into molds—in the forefront (p. 388)

DIE CASTING

Aluminum die castings may one day appear as automotive transmission housings, generator frames, motor end bells, fluid drive equipment and the like (p. 388)

Ease of casting, adaptability, machinability and cost and maintenance of dies are considerations presaging rapid peacetime expansion in uses for zinc alloys (p. 272)

Anticipate large demand for semiautomatic and large capacity die casting machines of new design (p. 272)

New alloys with improved physical characteristics enhance structural value of die castings (p. 272)

Very low cost of aluminum secondary alloys postwar will tend to increase metal's use, along with comparable developments for magnesium (p. 272)

Saving in machine work may yet provide inducement for shift from forgings to die castings, viz., parts rotating at extreme speeds (p. 388)

FORGING

s forgings to win greater minence in immediate future 384)

dical design changes on high-ed presses greatly increase dity, afford more accurate nment and greater speed 286)

w features available in post-r hammers will partly offset disadvantage of used equipment surplus (p. 286)

WPB parts pool order cuts hammer break-down time (p. 286)

Forging metallurgy faces reduction in variety of metals and alloys for greater variety of service applications (p. 286)

MACHINING

Tungsten carbides solve machining problem posed by glass-based phenolic resins (p. 282)

Hand-fitting methods in gear-making give way to automatic machines (p. 282)

Redesign of milling machines for negative rake tools seen (p. 282)

Reconversion challenges tool engineers (p. 284)

Hypermilling permits machining at speeds in excess of 20,000 feet per minute (p. 279)

New all-purpose oils function well in machine tool hydraulic systems, as well as for lubrication and cutting (p. 282)

Inspection devices on machine tools seen (p. 284)

Milling machines with flywheels, 50 horsepower motors and 12-inch cutters remove metal at rapid rate (p. 284)

Stronger trend noted toward use of more automatic metalworking equipment (p. 282)

New nonoxidizing hydraulic oils reduce machine down-time (p. 300)

Mist lubrication cuts maintenance costs (p. 279)

Important engineering developments in machine tool industry not yet translated into new models (p. 279)

New automatic machine eliminates separate operation for pointing bolts and studs (p. 279)

Petroleum-base rust-preventive facilitates storage of surplus tools (p. 296)

DRAWING AND STAMPING

New spring designs, materials to figure heavily in postwar program where ounces instead of pounds of material will count (p. 287)

Killed steel adopted for deep-drawing (p. 262)

Latest thin-wall cold-drawn cylinders hold close dimensions, withstand pressure of 3500 per square inch (p. 287)

Sheet steel now deep-drawn without wrinkling or tearing by improved hydraulic press method (p. 287)

HEAT TREATING

Longer-lived alloy box effective for pack carburizing (p. 291)

Isothermal annealing substantially improves machinability (p. 394)

"Skin recovery" process gives added protection against defects in steel parts (p. 396)

Wider acceptance of molten salt baths by heat treating industry predicted (p. 396)

Induction heating now a "big industry" requiring power in terms of 300,000 kilowatts (p. 291)

Radiant gas heat now practical for tin, strip lines and melting of metals (p. 292)

Low-hardenability heats circumvented by purchasing steel "on performance" (p. 291)

Stress control through selection of proper heat treating process advocated (p. 392)

Hardenability test will provide means of improving carburizing practice (p. 292)

High-frequency induction heating holds "great promise" (p. 291)

Efforts to control localized induction tempering watched with interest (p. 292)

Isothermal diagrams may save lost motion in heat treating parts (p. 292)

Nitriding top favorite for surface finishing cutting tools (p. 392)

Wartime progress in furnace building exceeds all previous periods (p. 291)

Much refinement noted in controlling carbon potential in atmosphere to equilibrium with carbon in steel (p. 314)

SURFACE TREATMENT

ELECTROPLATING

Electrodeposition of gold, nickel, chromium makes headway (p. 294)

Bright alloys provide splendid coatings for instruments (p. 294)

Shift in demand toward decorative plating foreseen (p. 294)

Interest in white bronze plating steel parts advances with possibility of unrestricted tin (p. 294)

Phosphate baths are producing bright, adherent finishes (p. 294)

ENAMELING

Porcelain enamel to replace expensive alloys in peacetime, especially in high-temperature service (p. 398)

Alkyd-type synthetic enamels and many new types of synthetic resin coatings will be commonplace among contenders in protective coating category (p. 398)

RUSTPROOFING

Hot phospate coating cited as primary inhibitor of corrosion (p. 296)

New pigment of chromated red lead being explored (p. 296)

Machinery stored for transition period must be properly protected from atmospheric attack with petroleum-base preventives (p. 296)

Petroleum derivatives for rust prevention will be available in number of consistencies (p. 296)

SHOT PEENING

Very tough chilled-iron shot produced by controlled heat treatment a distinctly forward step (p. 398)

Spring life increased 1370 per cent by shot peening (p. 398)

Shot peening process hurdles from spring to automotive industry to encompass gears, connecting rods, crankshafts, steering arms, universal joint parts, etc. (p. 398)

Shot peening installation self-liquidating due to elimination of polishing operation for many items (p. 398)

HOT-DIP GALVANIZING

Improved liquid flux opens door to mass-production galvanizing (p. 400)

METALLIZING

Times present many opportunities for building up worn parts, defective castings, etc. by metallizing (p. 400)

MATERIALS HANDLING

MATERIALS HANDLING

Explosion-proof fork truck to find market in chemical plants, oil refineries, coal mines, etc. (p. 368)

Management now favorably disposed toward equipment capable of making "through delivery" of loads from pickup to destination (p. 301)

To prevent glutting market with surplus used materials handling units, some manufacturers favor reverse flow back to their plants for reconditioning, sale (p. 368)

Continuing labor shortage accentuates value of materials handling equipment (p. 368)

Self-propelled diesel-electric side-dump ore transfer cars outstanding development in steel plant transportation (p. 301)

Modern equipment enables machine tool plant to handle four times prewar tonnage with cost and manpower halved (p. 368)

Important task confronting plant layout and materials handling engineers is designing plants to utilize in full economic values of new machines and equipment (p. 368)

Further adoption of handling on pallets points toward extension into many civilians goods fields (p. 301)

Improved bucket teeth for handling limestone and slag heralded (p. 301)

"Useful" segments of materials handling cycle for industrial crane must be kept in mind (p. 368)

LUBRICATION

LUBRICATION

Operating tests on motors with sealed bearings indicate 3-year operation without relubrication will be average (p. 287)

Oil-mist method developed for lubricating bearings and gearboxes cut oil waste (p. 279)

New tri-purpose oil may be used for hydraulic systems, lubrication and cutting fluid (p. 282)

Hydraulic oil life extended through use of inhibitors (p. 300)

IRON & STEEL

Foreign Ironmakers Consider Anthracite As Furnace Fuel

R. H. Sweetser, blast furnace consultant, New York: "Attention is now being given to anthracite deposits in three foreign countries with special reference to their suitability as blast furnace fuels. Two of these deposits are in the Western Hemisphere and near deposits of rich iron ores, and are being considered as foundations for establishing of iron and steel industries. Anthracite blast furnaces in the United States are now only a historical remembrance, yet with possibilities of being modernized and streamlined. Anthracite blast furnaces do not require capital expenditures for by-product coke ovens with their marketing problems for disposal of large volumes of coke oven gas. The prospective market for domestic sizes of by-product coke can just as well be supplied by the domestic sizes of anthracite.

"The trend towards the increasing use of Eastern magnesites may eventually swing some of the eastern blast furnaces to using egg-size anthracite, especially if any more natural gas lines move eastward.

"At the opposite end of the list of blast furnace fuels, as to density and hardness, stands charcoal which reached its lowest ebb for over 125 years as a blast furnace fuel in this country, in the production of charcoal pig iron in 1944, with only two charcoal blast furnaces left. Brazil uses nothing but charcoal as blast furnace fuel.

"The only new charcoal blast furnace plant to be built in this country since 1912 when Frank Roberts designed and built the furnace of the Delta Chemical & Iron Co., at Wells, Mich., is now being erected near Rusk, Texas (McCrossin Station on the Cottonbelt R. R.). A brief description of this plant was given in the Feb. 14, 1944, issue of STEEL. The steel work of the blast furnace plant is erected, and the brickwork of stoves and furnace is now being laid. The carbonization plant at Rusk will be of an entirely new design instead of the horizontal retorts such as were used at Wells, Mich.

"Contrary to the usual opinions about Texas there are vast hardwood forests in the eastern counties, and especially in Cherokee county, of which Rusk is the county seat. The Forestry Department of the State of Texas has made a special survey of the hardwood in the vicinity of Rusk and has reported that there is now standing enough to last the charcoal furnace for over 90 years within a radius of 20 miles. It is planned

that two hardwood seedlings will be planted for each tree cut down for charcoal. This will prevent what took place in Michigan, where 50 charcoal blast furnaces were built because of the abundance of hardwood and iron ore, and only one furnace remains because the hardwood has been cut off without reforesting."

Uniform Raw Materials for Better and Cheaper Steel

J. F. Meissner, vice president, Robins Conveyors Inc., Chicago 5: "Iron ore blending plants built in the previous year have now had the opportunity to demonstrate the promised benefits through operation of 1944. The results have been highly gratifying.

"Blending is the method of beneficiation applied to the basic raw materials, such as ore, coal and limestone, which does not remove impurities but so obliterates their irregular occurrence, that each will be of truly uniform chemical composition.

"Uniformly blended ores have brought about smoother operation of the blast furnaces, have increased the production of pig iron, have lowered the consumption of coke and stone, and have produced higher grade iron of uniform quality which also is reflected in better quality steel. The idea of blending coking coals is consequently receiving attention because of similar and added benefit to be obtained.

"Quality of raw materials has taken a sharp decline in recent years, yet the competition of the years ahead will demand more economical production of high-quality steel. Blending and beneficiation of the raw materials therefore should command increasing attention by the steel industry in the future."

Automatic Charging Control Furnishes Co-Ordination

Owen R. Rice, metallurgical engineer, Freyn Engineering Co., Chicago: "The advent of the larger blast furnace, with its broad and uninhibited appetite, brought under scrutiny the adequacy of furnace charging facilities. Grasping at the seemingly obvious, there was for a time a cry to "speed up" the movements of charging mechanisms. More thorough diagnosis has disclosed the fallacy of this approach. It has now been amply demonstrated that *co-ordination* is the all-important factor. Charging control, properly fitted to the individual furnace requirements, supplies the needed co-ordination most proficiently.

"Perhaps more than any other duties about the blast furnace, those of the charging men call for considerable fortitude in working under stress, and —what is even more important and as difficult to sustain—they demand a high degree of integrity.

"Many an unexplainable off-grade cast, many a burned tuyere, many a mysterious spell of hanging, may date back to some undisclosed dereliction in the charging cycle 14 hours before.

"Automatic blast furnace charging, competently designed and engineered, permits *no mistakes* in sequence or function.

"About the blast furnace are seen many improvements upon prior technique and apparatus. Ore is better conditioned, stoves are more efficient, burners are bigger and better. A few years ago, competent automatic charging did not exist as such. Today it is a well-developed reality. It is not an "improvement", it is a new departure. On this account, and because it is applied to so important a function of blast furnace operation, automatic charging control should rank as the outstanding engineering advance of the times in the blast furnace field."

Insulation Helps to Maintain Hot Blast Stove Temperatures

G. Dutney, Johns-Manville Co., New York: "More attention is being given to the design and performance of hot blast stoves because of the many changes required to meet the great wartime production capacity.

"As in all heat exchange process apparatus, the importance of adequate and proper insulation between the ring wall and steel shell is of paramount interest. The most satisfactory insulations for such service are those which combine the qualities of high-compressive strength, low conductivity, high-heat resistance and ease of application with minimum joints. In addition, they should be installed in sufficient thickness to provide high thermal operating efficiency while protecting the steel shell.

"Recently the need for a new type of oil seal became apparent, the most important requirements being a high factor of heel rigidity without the use of metal and greater flexibility in the lip than previously available. From the research laboratory has come this new development in bearing protectors called Clipper Seals.

"This seal is made with a heel of resin bonded fabric which gives it the rigidity essential for a press fit in the cavity and with a lip of a tough but soft flexible compound. The special lip design makes it possible to vary the bearing area and control the pressure of the lip against the shaft by means of a garter spring, thereby reducing shaft wear to a minimum. This type seal is being used in modern steel mills and their auxiliaries to help solve more exacting lubrication problems on all kinds of bearings."

Steelmakers Carry Out More Forward Work Than Year Ago

L. F. Reinartz, manager, Middletown Division, American Rolling Mill Co., Middletown, O.: "Scrap iron of a better quality is more plentiful. Considerable improvement has been made in the segregation of alloy steel scrap iron. Coal will be scarce this winter, and many plants will face temporary shutdowns because of delayed shipments. Due to efficient service of railroads, few steel plants have had to delay operations seriously because of lack of raw materials.

"In the manufacture of pig iron and 'hot metal' for open-hearth use, increased attention is being paid to quality, as indicated by high blast furnace hearth temperature and low-sulphur iron. Odd as it may sound, some operators have achieved good results by the judicious addition of steam to the blast.

"Use of sinter in the charge has assisted in obtaining larger production from furnaces, but it is still a moot question whether in postwar days the use of sinter will have enough advantages to justify its general adoption when the emphasis is again on low cost instead of maximum production.

"Because of labor shortages, lack of materials, and even state regulations, increased interest has been taken in suspended open-hearth roofs—silica, basic and Mullite. Suspended silica roofs in-

STEEL's Technical Worksheet for 1945 sets forth the technological progress of the metalworking industries as seen by outstanding men in the fields of steelmaking, casting, metallurgy, machining, lubrication, surface treatment, joining and welding, forging and materials handling. The remarks of nearly 175 men represented here not only recount the events of the past but present a birds-eye view of the developments just over the horizon which will have an important influence on metalworking in the years to come.

crease the factor of safety in roof patching, and should increase yearly furnace production. Basic ends from the slag pocket on up to port roofs in furnaces are being tried in at least three American plants. Long life of ends, decreased time for rebuilds, less slag, and more production are claimed for this innovation.

"Slag control is being refined and will assist materially in improvement of quality of steel ingots in postwar days. Metallurgists and operators are continuing their discussions about the relative merits of rimming and killed low-carbon steels for deep drawing and surface requirements for postwar steels. Deoxidation experiments are continuing. Improvements have been made in hot tops for killed steels.

"Attention has also been focused on proper cleaning of molds, and improved open-hearth pit practices. It is the current belief of many steel plant men that more attention should be centered on correct mold design, manufacture, and use.

"New refractories for open-hearth bottom and bank repairs have made their appearance. Due to tonnage demands, many open-hearth bottoms are now being rammed and burnt in rapidly. Good results have been reported by a number of companies.

"In processing and finishing emphasis is placed on continuity of operation and quality control. Gadgets of various kinds have been added to improve these controls. In strip mills much attention is centered on cleanliness and contour of surface, accuracy of temperature control in processing units, and reduction in mechanical damage to coils all along the line."

Flue Dust Output Decreased On Pressure Blast Furnace

A. J. Boynton, A. J. Boynton & Co., Chicago: "Operation of a large blast furnace at pressures within the stack, which have been purposely increased by throttling the gas outlet, has had its first practical trial within the year. The principal reported advantage is a decrease in flue dust production. Mechanical difficulties are considerable, and increase with harder blowing.

"This experiment is the first attempt to reconcile the disparity between the furnace diameters at bottom and top. The effect of this disparity in volume has been corrected by increased height, but nothing heretofore has been done to reconcile the upper diameter with the lower, and so to lessen the excessive gas velocities through the stack. The high-pressure method, while producing an effect similar in some respects to those resulting from an increased top diameter, may turn out to be a hard way to accomplish this object. The alternative is the development necessary to enable a substantial increase in stockline diameter to be made. A chief item in this development would be modification of the simple bell and hopper charger, which at present limits the top diameter.

"It is difficult to believe that the same industry which developed the strip mill would have any difficulty in producing a suitable charger once a concerted effort was made. Like all blast furnace changes, the details would require to be developed empirically and would take time. Once the changes were worked out, the gas velocity in our larger stacks would be decreased to about 80 per cent of the present, with a dust carrying ability of 64 per cent and a dust production much below this figure. With the present gas velocity through the top, the rate of driving, and presumably the production, would be increased by 25 per cent. It would seem that this approach to economy should be tried before any permanent conclusions are drawn as to the necessity and value of high-pressure operation."

Electric Steels Are Made With Sponge Iron Base

Fred Magis, metallurgical engineer, Henry Disston & Sons, Inc., Philadelphia: "Disstons used Swedish sponge iron of high purity as a base in electric steel melting, from 1926 to the latter part of 1940, when due to the war, shipment of this material from Sweden was stopped. We found from comparative tests, that steels made with sponge iron as a base are superior to those made from all-scrap charges. This agrees with the results of investigations made abroad.

"The beneficial qualities of high-purity sponge iron is due in part to its greater freedom from detrimental gases and nonmetallics in solution with the iron, than in any other melting base except high-quality muck bar. The quantity of detrimental impurities is low, and, owing to the method of production is in gangue form, which rises into the slag during the early stages of melting. The iron oxide content which is less than 4 per cent produces a light boil in melting, which is desirable. The low content of alloying elements in sponge iron, makes it easier for the steelmaker to meet chemical specifications.

"Recently we made several heats with sponge-iron that was produced at Salisbury, North Carolina, from Cranberry magnetite concentrate. This sponge iron made by the process developed at the Bureau of Mines, shows promise according to the tests made to date. The average chemical composition of this material compares favorably with the Swedish brand.

"The growing difficulty for the maker of high-quality electric steel in obtaining scrap free from alloys, makes the application of sponge iron as a melting base in this field desirable."

Better Grades of Steel Are Produced at Increased Rate

G. A. Dornin, Dornin Moulds, Youngstown, O.: "The most significant development in the steel industry since the beginning of the war has been the tremendous increase in the country's capacity to produce better steels. The country's production of all grades of steel has increased about 25 per cent while its capacity to produce the better grades as evidenced by its capacity to produce electric furnace steels has increased over 500 per cent in the same time.

"I wish to predict that the use to which this increased steel producing capacity will be put after the war will be in making better steels.

"The tonnage steels such as rails, plates, sheets and structural steels have in the past been made largely from rimmed and semikilled steel which I personally consider half made steels. They age harden and thereby become unreliable with age. I expect to see them all made nonagehardening and thereby reliable."

Improvement in Air Preheaters Provides Against Leakage

P. M. Offill, vice president, Amsler-Morton Division, Union Mining Co., Pittsburgh: "One of the 'musts' for postwar competition will be an efficient air heater to reduce the consumption of fuel and to increase the productive capacity of the furnace. Air preheating or air recuperation has reached its present state of efficiency after a lot of growing pains that often left furnace designs, as well as engineers and operators, in doubt as to its feasibility as a heat salvaging device. The early pitfalls of recuperator design were high conductivity materials and long tortuous horizontal waste gas passes. These conceptions misdirected the efforts of designers until an open minded operator, plus a furnace with particularly dirty waste gases, offered the opportunity to try a recuperator with one short vertical waste gas pass downwardly and a series of shuttle passes upward for the air.

"This move sidestepped the difficulty of dirt deposits on horizontal surfaces, which has resulted in the reduction of heat transfer, because the dirt was carried or fell through to flues beneath.

"The next step was perhaps as radical

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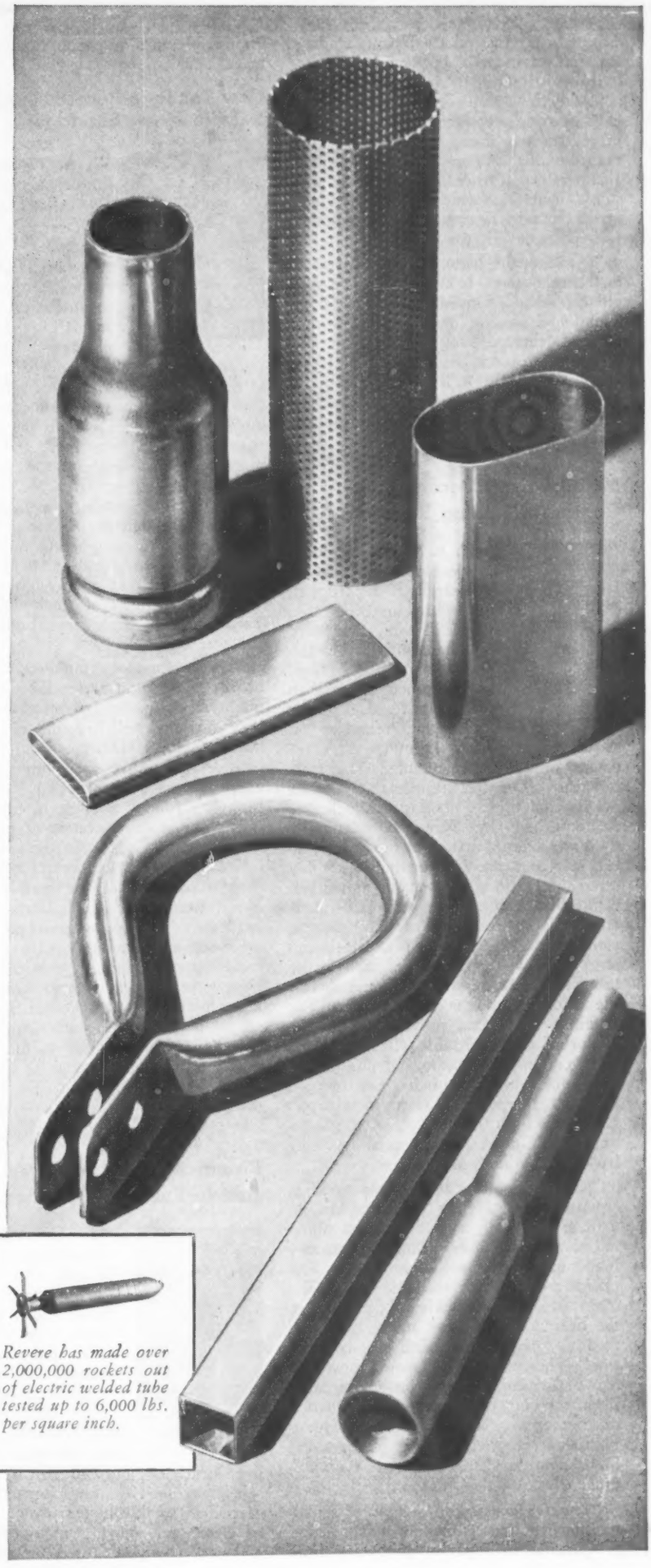
Electric Welded Steel Tube by REVERE



These shapes are just a few of the thousands that have been made of Revere Electric Welded Steel Tube. It is so workable that a great number of parts and products can be made of it. Here are some of the operations customarily performed on these tubes:

Expand	*Plate*
Flange	*Flatten*
Bend	*Taper*
Bead	*Swage*
Machine	*Grind*

Weld

Revere Electric Welded Steel Tube is not just tube. It is available in various exactly-controlled hardnesses, and not only round but in almost any desired shape. It can be supplied in various tempers, annealed or normalized, as required. Dimensional tolerances are held to strict standards. We can so process the tube that it is impossible to ascertain the location of the weld. There is literally a Revere Welded Steel Tube for every steel tube use. Sizes up to 4½ inches O.D., wall thickness up to #7 B.W.G., .180 inch.

We not only supply steel tube in straight lengths, but also fabricate it into parts that will fit into your assembly with little or no additional processing. One customer reports saving $9 per unit when he switched to Revere Electric Welded Steel Tube. For further information write the Revere Executive Offices.

Revere has made over 2,000,000 rockets out of electric welded tube tested up to 6,000 lbs. per square inch.

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as the first. Instead of depending on a material having a high thermal conductivity to transmit a large quantity of heat, a thin wall section of material having lower conductivity high storage properties was used. In batch-type operations this storage factor made the recuperator a 'thermal fly-wheel' that stored heat from one cycle and gave it up in the next to create a high-temperature potential in the furnace.

"Leakage, the bane of all recuperators in the early days, is avoided by the simple expedient of making all joints horizontal and sealing them by the weight of the structure itself. Expansion and contraction cannot affect this type of seal and, as a result, it is possible to blow air through the recuperator under sufficient pressure to operate modern burners efficiently."

Metallurgists Concerned with Control of Melting Reactions

J. S. Marsh, engineer, development and research department, Bethlehem Steel Co., Bethlehem, Pa.: "For some months metallurgists have been concerned more than ever with controlling melting reactions in the direction of the highest possible recovery of alloying elements. The matter was of especial importance during the days of critical shortages; much was accomplished by way of conserving stocks of virgin materials through careful selection and segregation of alloy scrap and through controlled melting. Controlled melting presupposes knowledge of the reactions of the alloying elements in the presence of steel and slag; and we are indebted heavily to the chemically minded metallurgists for the information amassed to date. For example, their data prove that the behavior of the oxidizable elements, such as chromium, manganese, and phosphorus is similar; high residuals are favored by high temperature, low metal oxygen (i.e., high carbon), low slag volume, and other items, such as slag basicity in the basic process.

"Knowledge of melting reactions is equally applicable to the problem of making steels of low contents of alloying elements such as nickel, copper, molybdenum, chromium, manganese, and phosphorus. Since the first three elements are not oxidizable in the sense of the behavior of the last three, it follows that they can be controlled best by dilution. The oxidizable elements, however, can be minimized by inverting the steps listed for high recovery; thus elimination of chromium, manganese, and phosphorus is favored by low temperature, high metal oxygen, and high slag volume.

"The growing knowledge of steel-melting reactions is making it increasingly possible to separate probables from improbables in on-paper furnace practices."

New Tonnage Records Made Despite Many Shortages

W. A. Peters, metallurgist, Laclede Steel Co., Alton, Ill.: "Under wartime stresses, regrettable as they may be, tremendous strides are made in technological developments in practically all fields. The steel industry is no exception. In spite of severe manpower shortages, and drastic scarcities of many raw materials, the industry has forged ahead to set new tonnage records in every field, and of even more importance to the future, new highs in quality and yields. Never before has such an opportunity been presented to follow through the results of research and changes in open-hearth melting, refining and pouring pit practices on rolling properties and surface condition of the various grades of steel which have been made in such large tonnages for the war effort.

"The tremendous influence of open hearth pouring pit and mold practice on quality and particularly surface condition and yield on all grades of steel has been a factor seldom taken into adequate consideration until such huge tonnages of 'quality steels' afforded the opportunity to follow through in minute detail the effects heretofore considered trivial. In no place in the steel plant is careful and strict control of practice more important than the open-hearth pit. Many potentially good heats of steel have been spoiled by poor pit practice or inadequate facilities. On the other hand many a heat of poor quality has been improved in the open-hearth pouring pit by intelligent practice to such an extent that it fully meets quality specifications. In no place in the steel industry is there more room for further research and improvement and such rich rewards to be realized in both quality and yield as this department."

Research on Atmospheres Assists Furnace Operator

M. H. Mawhinney, consulting engineer, Salem, O.: "One of the interesting problems which have become important to the steel industry is the control of the chemical effects of furnace gases on steel when heated. Continuous research on atmospheres in both open-fired heating furnaces and in furnaces with special protective atmospheres has succeeded in establishing many of the laws of cause and effect which govern the chemical changes caused by heating in gaseous atmospheres (scaling and decarburization are two of the principal results).

"Engineering problems involved in applying these laws are now being solved more rapidly than is the problem of educating executives and operators in the importance and necessity of exact control of the resulting furnace equipment. This control must be as accurately regulated and as rigidly enforced as it is in the accepted melting practices, but this fact is far from generally recognized as yet.

"Development of furnaces and instruments for furnace atmosphere control is expected to advance rapidly after the war, and it is to be hoped that educational efforts will keep pace with this development, in order that full advantage will be taken of the abilities of this equipment to improve quality and reduce costs.

"These developments, spurred by experience being gained in these war years, will include control of open furnaces by supervised instrumentation, atmosphere furnaces for heat-treating, annealing, and for 'skin recovery' of carbon lost in forming processes, and determination of the proper uses of salt treatments and of induction heating for surface control."

Temperature Measurement of Liquid Steel Shows Progress

H. B. Emerick, steel works metallurgist, Jones & Laughlin Steel Corp, Aliquippa, Pa.: "Temperature control of steelmaking operations has been handicapped in the past because methods for determining temperature during the refining of the heat have frequently been inaccurate and unreliable. Recently, however, independent research by several different steel plants and co-operating instrument manufacturers has resulted in the development of equipment which gives every indication of fulfilling the pressing need for quantitatively accurate instrumental means of determining molten steel temperatures.

"One of the more promising inventions is that by U. S. Steel Corp. for modification of the Collins-Oseland open-end tube using a photoelectric (photronic) cell as the radiation sensitive unit for converting the radiant energy of the bath to electrical energy for recording purposes. Another adaptation of the Collins-Oseland tube which is being actively developed involves the use of a high-speed radiation sensitive thermopile together with suitable recording equipment for reading the output voltages; this equipment, when perfected, will favor a high degree of speed and accuracy, and a minimum maintenance cost.

"In one basic electric shop each furnace has been equipped with a quick-

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immersion pyrometer consisting of a platinum, platinum-rhodium thermocouple protected by a fused silica tube mounted in a block of graphite. Within 15 seconds after immersing the exposed tip of the silica tube in the bath the temperature is recorded on an electronic potentiometer type recording instrument.

"To the furnace operator these developments signify an opportunity to improve steel quality and furnace life, and reduce refractories costs; to the metallurgist and the research engineer they afford for the first time adequate means to study and control the complex physical chemistry reactions involved in the steelmaking process."

Recorded Flame Temperatures Serve As Valuable Guide

M. J. Bradley, market extension division, Leeds & Northrup Co., Philadelphia: "Emphasis continues to be placed on production, quality, and efficiency in the open-hearth process. Details connected with maintenance, repairs, scheduling, charging, working, tapping, and teeming have been worked out with precision and all avoidable delays and interruptions have been cut down approaching an irreducible minimum.

"Result of these studies has transferred the emphasis onto what takes place within the open-hearth furnace itself. Tons per hour (or production of steel) is recognized as a product of furnace operation. Combustion engineers are studying flame conditions as a means of controlling combustion in order to obtain better flame temperatures throughout the furnace for the various stages of the heat. This has resulted in locating the maximum flame temperatures immediately above the bath on the incoming end of the furnace, thus increasing the possibility of obtaining the maximum heat transfer from the flame to the bath.

"During the early stages, when flame readings were taken through the wicket hole in the furnace door, it was found that these readings were subject to variations due to the heat head within the furnace and only represented the conditions which existed at the time. Also that the conditions changed greatly at different stages in the heat even with the same volume of fuel. Flame study procedure has now changed to continuous recorded measurements of the flame and slag temperature throughout the furnace operation. This procedure not only gives more information on which to evaluate the flame conditions but provides a valuable guide for the furnace operator in regulating the combustion air, atomizing steam, and liquid fuel. This is a new tool now being used for better fuel efficiency.

"The combustion problem is being studied by another method. The products of combustion—or the waste gases—are being sampled and analyzed continuously to determine the percentage of oxygen present. This is a rapid method of determining the amount of excess air being used and the heat being carried away by the excess air. This is also a new tool for the furnace operator.

"Effects of flame conditions, temperatures, and heat-head above the open-hearth bath are being studied by measuring the temperature of the molten steel within the bath during the finishing of the heat. These temperatures furnish an accurate guide for the tapping range and teeming the ingots. If the steel is teemed at too high a temperature, the result is mold stickers, and, if tapped at too low a temperature, ladle skulls cut down production. Bath temperature is a new tool to increase not only quality but also production and efficiency."

Serious Alloy Contamination Is Not Viewed with Alarm

E. C. Smith, chief metallurgist, Republic Steel Corp., Cleveland: "Immediately before the war the United States was producing steel at a yearly rate of 50,000,000 tons. Of this, 6 per cent was alloy steel. The war needs for alloy steel climbed faster than those for carbon steel, reaching about 17 per cent of total production in March, 1943. Since that time alloy ingot production has had a general downward trend.

"The peak of alloy production, March, 1943, was about a million tons of alloy steel; about three-fourths of which came from the open hearth. Electric furnace production peak did not occur until October, 1943, when about 350,000 tons of alloy was made in this fashion. The peak of overall steel production was in March, 1944, at which time the alloy made was 13 per cent of the total. Of this the electric furnace was still making over 300,000 tons of ingots, while the open-hearth alloy had dropped to about 600,000 tons ingots.

"Nearly all this alloy steel went for war work, from which the scrap returned to steel plants would follow in about 9 months.

"Thus, the peak of alloy problems should have been about December, 1943. With the continued high production of carbon steel and the separation of alloy scrap, much of which found its way into the electrics, the problem of residual alloy in carbon steel should become easier each subsequent month of the high total production.

"While the justifiable and proper alarm of 1943 saved much alloy waste and permitted the carbon steels to remain relatively uncontaminated, it would appear that, with any reasonable volume of carbon steel from here out, we need not fear serious alloy contamination.

"Should steel production fall back to 50,000,000 tons and scrap separation cease, the producers of carbon steel would find it difficult to absorb the war scrap, with its alloy, in the low volumes of steel being made. However, with any fairly full operating program the problem of residual alloys should be controllable."

All-Scrap Open-Hearth Heats Afford Lower Mix Cost

P. S. Kingsley, chief metallurgist, Follansbee Steel Corp., Toronto, O.: "An attractive way to reduce steelmaking costs is the use of the all scrap-carbon charge particularly where the basic open-hearth charge operates on cold charges. The Toronto, O., shop of Follansbee Steel Corp. includes 45-ton basic oil-fired furnaces of conventional design. Carbon in the form of graphite and petroleum coke is charged on the bottom, followed by 1000 pounds of spiegel to give a 15 per cent manganese content in the melt. These raw materials are then covered with a layer of silicon sheet scrap and burnt lime. The remainder of the scrap is charged in the most advantageous way to keep the charging time to a minimum. High manganese mill crops, ranging from 1.80 to 2.00 per cent manganese are used instead of spiegel whenever they are available. The silicon added to the bath to keep the carbon from too rapid oxidation is obtained from silicon sheet scrap averaging about 3 per cent silicon.

"The time of heat, type 1040, from charge to tap usually averages about 10¼ hours. Steel is tapped at a temperature of 2940 degrees Fahr. and poured between 2750 and 2800 degrees Fahr. using a 1¼-inch nozzle. Molds are 15 x 15 x 52 inches, and are sprayed at a temperature of 375 degrees Fahr.

"Results are comparable with those obtained from conventional pig-scrap charges in the same shop. This practice is no cure-all for the troubles normally encountered in open-hearth operation; about the same percentage of soft metals, raw slags which have to be shaped up, and time-consuming high melts will be encountered. It does, however, with proper supervision and metallurgical control give as good quality and yield with a materially lower mix cost."

Steel Sheets Are Improved by Better Processing Control

F. B. Poto, mill representative, Inland Steel Co., Indiana Harbor, Ind.: "While there are many severe drawing jobs incidental to the production of stampings from steel sheets for wartime purposes, the number of such is much less than those for normal peace-time requirements. This has been helpful in obtain-

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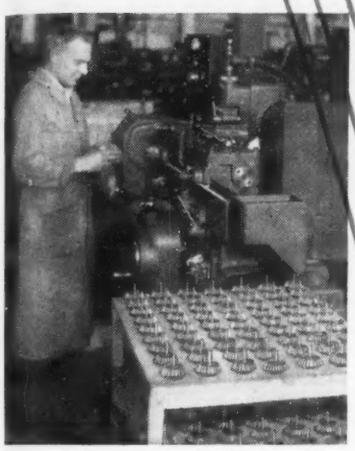

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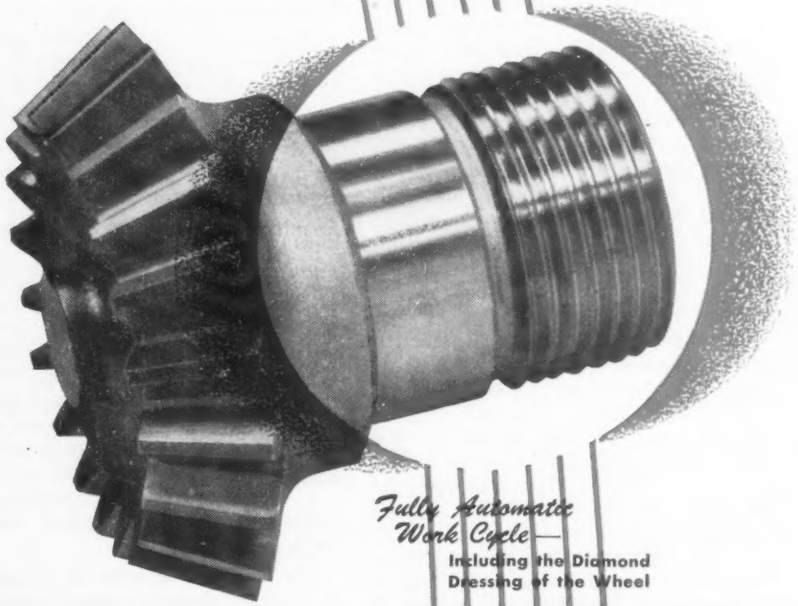

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ing full production of stampings for war when maximum production is vitally necessary, but it has not been conducive to the normal improvement in the standard product, or in the development of new sheets.

"Nevertheless, considerable improvement and development have occurred. Sheet quality has been improved largely by virtue of better control of the various steps in the processing. This applies not only to the relatively new killed drawing quality steel, but also to the older sheet from rimmed steel. Moreover, the application of the former has been greatly extended and, no doubt, will continue to expand in our peacetime production. Experience indicates the desirability of applying this type of steel not only on severe drawing jobs, but on those where the hazards from aging are aggravated by the fabricator's small schedules and lack of proper equipment. The extra cost of this excellent steel is now partially offset by a higher price than that of rimmed steel and is in accordance with a recent ruling of the OPA.

"A recent development is the production of a titanium alloy steel sheet known as Ti-Namel which allows the application of a white coat enamel directly to the steel base without an intermediate ground coat, and, with none of the defects arising when an ordinary white coat is fired on a regular iron or steel base.

"Development of this new enameling steel, in co-operation with the Titanium Alloy Mfg. Co. and the frit companies has required a great deal of experimentation in working out the special processing found necessary."

Matched Motors Drive Single Stand 4-High Plate Mill

G. E. Stoltz, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.: "One of the most significant electrical applications made in the steel industry during the year 1944 is a twin motor drive for large reversing 4-high plate mills.

"During World War I the plate mills that were added to take care of increased demand for ship plate were 3-high nonreversing mills. The use of 4-high mills to roll tin plate and automobile sheet has been extended to the rolling of plate during the last ten years.

"Again during World War II, new plate mills have been installed for the increased demand of plate for ships, tanks, and armor of various types. The new mills were of the 4-high reversing or continuous nonreversing tandem type. All of these mills had their working rolls driven through a conventional set of pinions.

"A departure from this practice was made with the installation of a single stand 160-inch 4-high plate mill on which the pinions were omitted and each working roll driven separately by matched motors constituting a variable voltage twin motor drive. The omission of pinions eliminates any possibility of tooth marks on the finished plate and obviates any necessity of matching roll diameters. Sufficient operation has been obtained to indicate that no difficulty will arise in guiding the thin plate down into the table rolls or above the normal table level. The operation in general has been satisfactory, and there is every indication that further use of this type of drive will be made in the future."

Modernization of Rolling Mills Is Contemplated

F. Mohler, engineer, steel mill section, industrial engineering division, General Electric Co., Schenectady, N. Y.: "Developments in the steel industry just prior to and during the war give convincing evidence that we may look forward to the modernization of most existing mills from the standpoint of higher speeds of rolling, and faster and more automatic operation.

"Development and perfection of certain tools such as the amplidyne, electronics, electric gages, instrumentation, and X-ray equipment will play an important part in making high-speed rolling, fast operation, and automatic control possible.

"For instance, 22 reversing mills already have been equipped with amplidyne control, which not only eliminates contactors carrying hundreds of amperes and replaces them with contactors carrying fractions of an ampere, but has made their operation faster and increased production as well. A tandem cold strip mill with amplidyne control has been operated as high as 4100 f.p.m., and mills are under discussion for operating as high as 6000 f.p.m. Temper mills have operated as high as 4000 f.p.m. and, again, mills having speeds of 6000 f.p.m. are being contemplated.

"A temper mill, called the Unitemper mill, is operated consistently at 2700 fpm, and speeds are contemplated as high as 5000 f.p.m. This mill operates on a new principle and tempers are possible which were not obtainable before. Its success is largely dependent upon the accuracy of the complicated control equipment.

"As a matter of fact, the amplidyne has proved an extremely useful tool in the control of practically every type of mill, processing line, and arc furnace wherein it is required to control voltage, current, speed, power factor, or any combination of these functions.

"Electronics have been applied to many problems requiring great accuracy such as the flying shear, reel alignment control, high-speed coilers, automatic loop control, automatic screwdown control, and a host of others almost too numerous to mention.

"Instrumentation and gages are opening the field for automatic quality control, and a lot can be expected along this line."

Future Uses of Stainless Wire Expected To Be Large

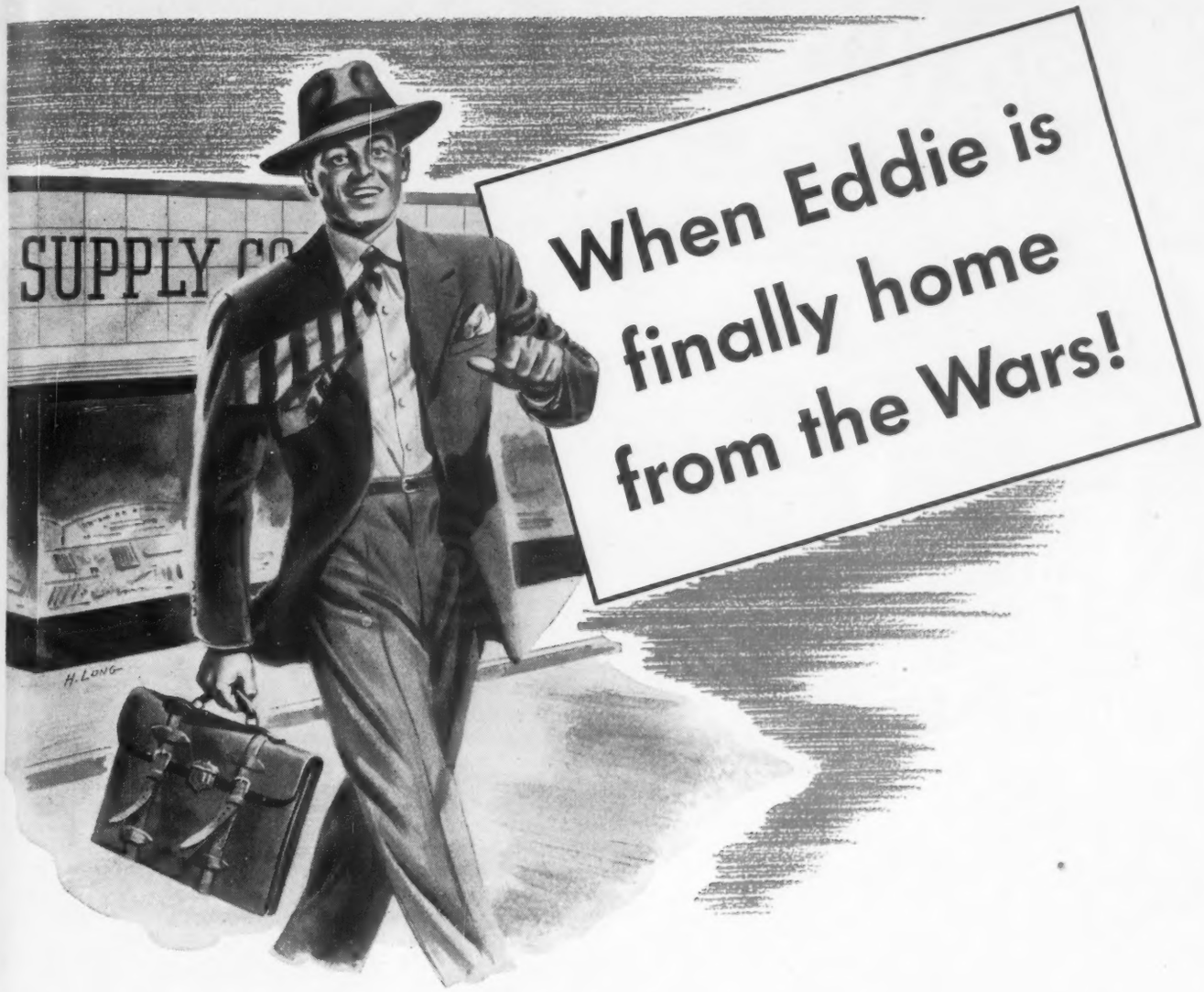
J. K. Findley, metallurgical engineer, Allegheny Ludlum Steel Corp., Dunkirk, N. Y.: "At present, there are few new uses of stainless or corrosion resisting wires. For the past three years these wires have been used only for the fabrication of articles where it was known that their ballistic, heat-resisting or corrosion-resisting properties were essential to the necessary life of those articles. Although the variety of uses has been limited, the quantities needed made it necessary for stainless wiremakers to increase their facilities for producing both the larger and smaller sizes.

"How much of the present capacity will be needed to supply stainless wire for ordinary civilian use when such use becomes permissible is something that may soon become a problem. However, a study indicates that the quantities used in the future will be greater than during the last several years. The enduring bright appearance of articles fabricated from stainless wire, especially after giving the articles an anodic luster or electrolytic polish, is bound to regain a large market for this grade of wire. The trend to longer life design in equipment for the chemical, paper, and food industries will require wider application of stainless wires."

Used in Treatment of Wire Electric Resistance Heating

J. P. Zur, engineer, Trauwood Engineering Co., Cleveland: "One of the most important advances in the continuous strand heat treatment of steel wire has been the development of patenting, tempering and annealing by the electric direct resistance method.

"In this new process the heating effect of an electric current, applied directly to the wire being heat treated, is utilized for extremely rapid and uniform heating through the cross section to the required temperature. Electric resistance heating, as employed in the Trauwood process is over 90 per cent efficient; practically all of the electrical energy applied to the wire is converted



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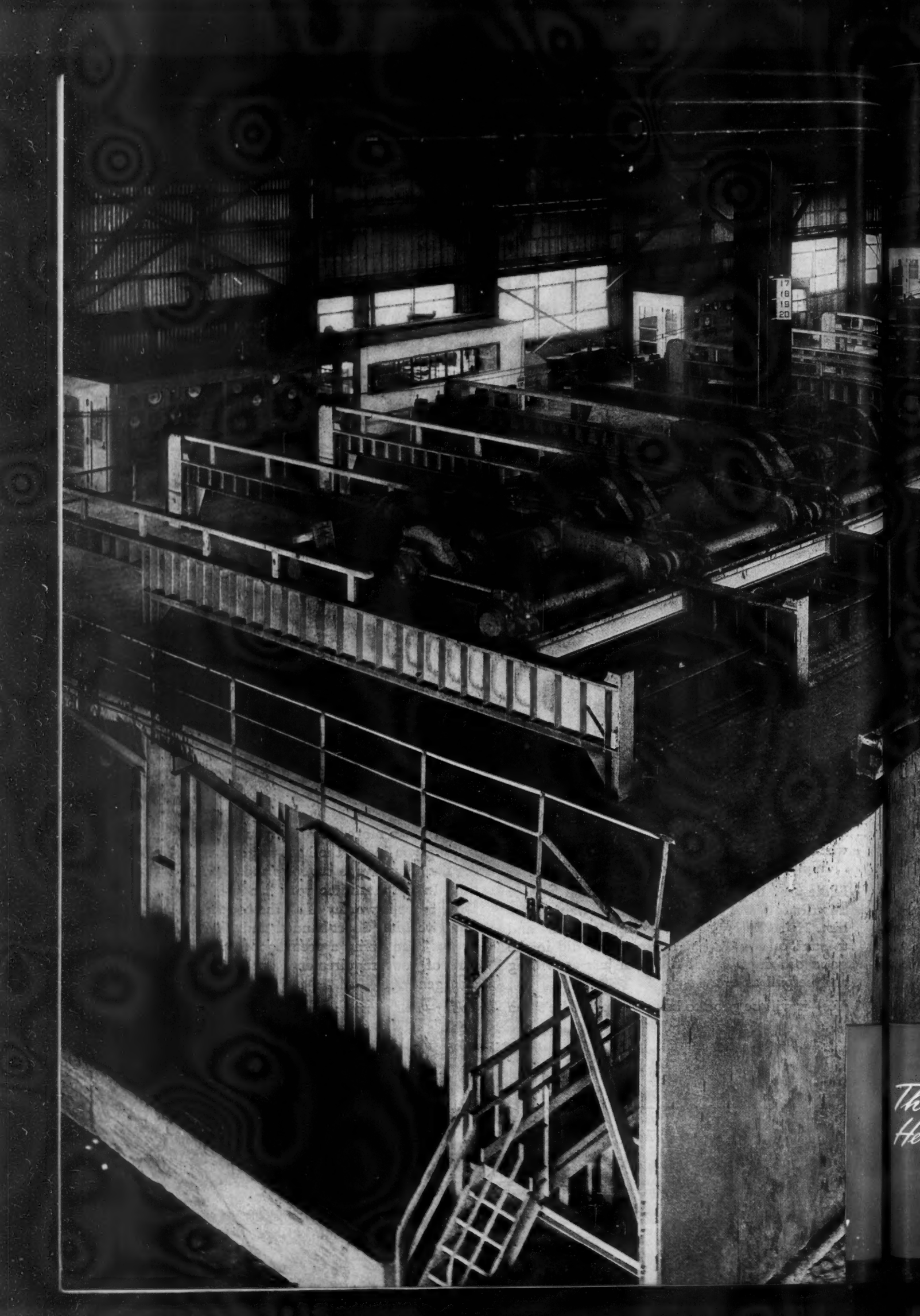
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"WHEREVER HEAT IS USED IN INDUSTRY ...FROM INGOT TO FINISHED PRODUCT"

into heat, and radiation losses are reduced to a minimum.

"During the past several years direct resistance equipment has been installed in many wire mills for patenting high-carbon steel wire, annealing low-carbon steel wire, tempering spring wire, and annealing stainless and other austenitic steel wire. Uniform physical and fatigue properties are obtained, large production is assured, and overall costs are minimized. There is no surface decarburization, and practically no scale on wire heat treated by direct resistance, consequently there are appreciable savings in the cost of pickling and cleaning the various grades.

"Among the other advantages of this process are: flexibility, fully automatic and easy operation, positive temperature control, and ability to duplicate exacting heating and quenching cycles from day to day.

"This newest development in continuous strand heat treatment of steel wire brings out the optimum qualities of a given steel, thereby opening new fields of application for those engaged in the wire industry.

Chemical Specifications of Wire Merely Starting Point

R. R. Tatnall, metallurgical engineer, Wickwire Spencer Steel Co., Worcester, Mass.: "One of the recent developments in uses of metals is the purchase of steel to performance specifications rather than to strict chemical analysis alone. This has had particular reference to hardenability in recent discussions, without much consideration of other characteristics which may often be equally important.

"The wire manufacturer has been working to this concept of the usability of his product for a long time. With the extremely wide range of properties available in a wire of given chemical analysis, it has often been necessary to go beyond simple tensile strength or ductility tests in order to obtain a criterion of the suitability of the product. In turn, tests such as workability for cold forming or upsetting, properties of elasticity or plasticity, or perhaps fatigue endurance have entered specifications for control and purchase. Such tests are necessarily geared closely to the specific use of the wire.

"The manufacturer gages his processes to result in required performance characteristics that can never be attained by specifying chemistry alone. Hardenability of itself is seldom, if ever, a factor in the section which the wire-maker produces. It is little realized how thoroughly wire, particularly manufacturers' and specialty grades, is tailor-made to fit the requirements, not only of the purchaser's operations, but also for the service performance of the finished part. Such tailoring is largely independent of the chemistry of the steel used, and is worked out by the wire manufacturer in close co-operation with the wire consumer. Thus, the specification of chemistry alone in the purchase of wire, is more often than not, only the starting point, and materials engineering for performance characteristics always has governed in the development of a suitable wire product."

Tendency Is To Increase Strength of Steel Wire

H. C. Boynton, consulting metallurgist, John A. Roebling's Sons Co., Trenton, N. J.: "Spurred on by the War's demands, a growing tendency has been noted to increase the strength of many brands of high-carbon steel wire. By increasing the strength of wire 10 to 20 per cent, the manufacturer often can decrease the size of the rope needed or can increase the load moved.

"Aircraft manufacturers have been quick to demand smaller, lighter and stronger ropes and cords for controls and other uses. Whereas in the past, 300,000 psi was about tops for many sizes of finished wire, now 350,000 to 400,000+ is not at all rare for small sizes of aircraft wire.

"Use of 'Bruntonized' wire (wire that is hot galvanized then cold drawn to finished size) is decidedly on the increase, as it has a higher tensile and proportional elastic limit than the same size wire hot galvanized after wire drawing. Such wire is replacing tinned wire to a great extent when used for the same purpose.

"Twelve to 14 per cent chromium and 18-8 stainless steel, which in 1943 jumped over 34 per cent in production, when used for wire as well as for other purposes, is decidedly on the "up." Today most wire manufacturers are cold drawing 18-8 stainless wire. Low-carbon 18-8 stainless steel can be cold drawn to meet the strength of high-carbon steel wire in the finer sizes reaching 350,000 to 400,000 psi and above. Stainless steel fitting can now be pressed or swaged onto cords, etc. developing 100 per cent of the strength of the cord.

"A decided trend in wire drawing practice is to eliminate lime in cold drawing and draw the wire after acid cleaning by immersing in a hot alkaline medium, allowing the wire to "cook" there for a short time, then removing, drying thoroughly and wire drawing with no long baking nor lime. Such brown or black coats are somewhat rust resisting, much more so than lime-drawn wire which is always more or less hygroscopic. Other coatings sometimes used may be developed by treating in various solutions of nitrates and nitrides; the solutions are oxidizing in nature and leave a nice, black, rust-resisting coat similar to a "gun metal" finish.

"Another well-known method uses mixtures of phosphates in solutions which, under proper processing, produce various colored coats on wire. In general such methods are attractive and more durable, but more expensive than the old fashioned 'brown coat.'

"Reconditioning of zinc coated wire is interesting in that zinc normally forms a 'white rust' when exposed to damp or marine atmospheres. By suitable after treatment zinc coated wire can be turned either black or yellowish, like an 'olive drab,' which treatment greatly increases the life of the zinc wire and holds back the formation of white rust for a longer period of time than the untreated galvanized product."

Many Improvements Occur in Cold Finished Bar Industry

H. M. Brightman, assistant to president, Columbia Steel & Shafting Co., Carnegie, Pa.: "Close control of analysis and finishing temperatures by bar mills has materially aided cold finishers in producing more uniform physicals in their cold finished product. Improved instrumentation of heat treating and heat treating methods, in relation to drafts and analysis, has made it possible to produce more uniform results in physicals and machinability. Chemical additives to pickling bath, in conjunction with the use of sintered dies in the cold drawing operation, has improved surface finish.

"Improved bar pointing equipment with hydraulic feed and hydraulic variable speed, promotes more efficient operation over the full range of sizes. Better designed drawbenches in combination with hydraulic push pointer, permit heavier drafts as required to meet physicals, and reduce maintenance to a minimum. Improvement to multiple roll straightening and polishing equipment has produced better fade-out in the smoothing operation.

"Further study is being made as to controlled deflection in the uni-directional, as well as the angular-directional method of straightening.

"Industry is faced with a great challenge in the field of human engineering in regard to management-employe co-operation. To assure future success, we must establish understanding through closer management-employe relations in order that co-ordination truly exists in the functioning of the various departments and there is a smoothly operating unit—complete unit, producing a quality product in large quantities, at a low pro-

(*Please turn to Page* 372)

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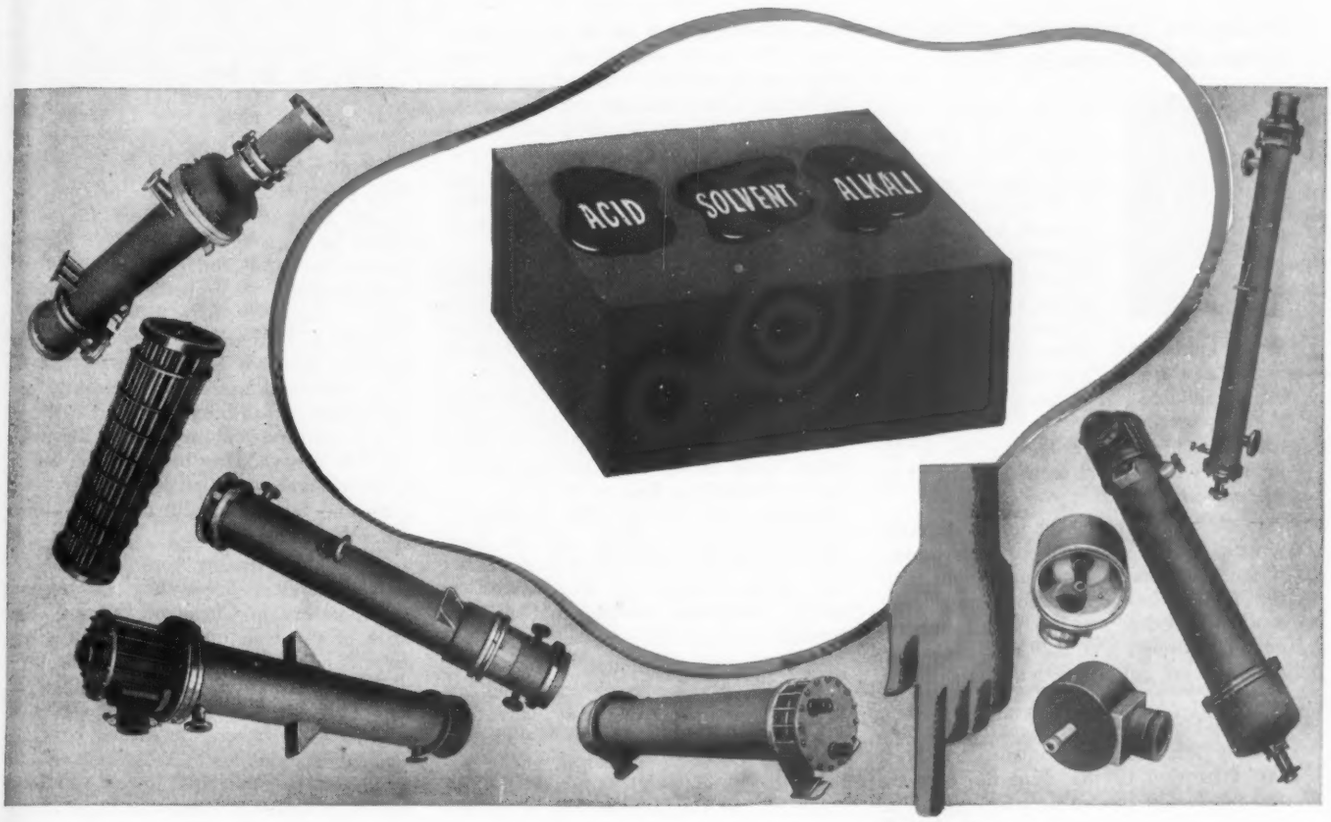

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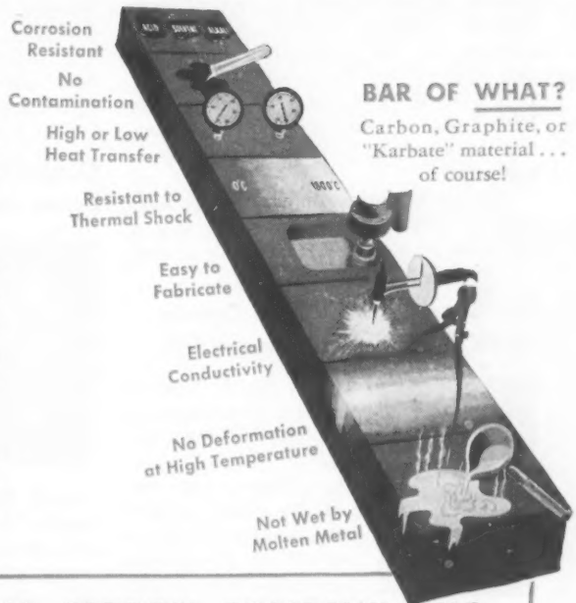

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CASTING

Duplexing Process Makes More Progress in Malleable Field

M. F. Becker, vice president, Whiting Corp., Harvey, Ill.: More than 50 per cent of all equipment and materiel being manufactured in the United States for waging war against our enemies contain castings of some kind, and these must be produced first before assembly of the finished products can be started. In order to carry out their responsibilities, some foundries are now operating 16 to 22 hours per day, which was unheard of in the prewar period.

"Due to the severe shortage of manpower, the trend in foundries has been to mechanize most of the operations from the yard, where pig iron, scrap, coke sand, and other raw materials are received, through the melting, annealing, and cleaning departments to the shipping floor.

"The biggest development of the past year in the malleable industry has been the expansion of the duplexing process for producing malleable castings. This process utilizes a cupola (a vertical shaft furnace which is highly efficient) for melting the raw materials and refining and superheating the metal in pulverized coal-fired air furnaces. Foundries also have begun to use equipment for reducing the moisture in the blast on cupola operations.

"As far as future operations are concerned, the successful plants are going to be those who mechanize and clean up."

Bell-Type Radiant Tube Covers More Accessible for Heavy Job

J. H. Smith, general manager, Saginaw Malleable Iron Division, General Motors Corp., Saginaw, Mich.: "One of the outstanding developments in the heavy casting field of the malleable iron industry during the past year has been the introduction of the rectangular bell-type radiant tube annealing covers, similar to those used in the annealing of sheet and strip steel.

"Heavy truck castings weighing from 60 to 360 pounds, such as banjo and carrier housings, are loaded on a refractory base. A 23-ton cover which carries the radiant tubes and combustion equipment is lowered over the white iron castings. The outer rim of the cover fits into a sand seal which maintains a gas-tight seal. The castings are brought to temperature as rapidly as possible and produce their own atmosphere by the burning of the carbon from the surface, which is maintained within the proper proportion throughout the entire heat treating cycle.

"Most of the large truck banjo housings malleablized at present are heat-treated in muffle ovens, which requires from 8 to 10 days. The handle of these heavy castings in and out of these ovens is slow and difficult. The radiant tube covers are much more accessible in this respect. At present, a 65-hour cycle is being used which will be further reduced, possibly as low as 50 hours. No containers are used for the malleablizing of the large castings. For medium and light section castings, it is necessary to load the castings in alloy baskets to permit maximum tonnage to be heat treated.

"The furnaces are fired with natural gas and the temperatures controlled automatically by recording controllers. One thermocouple is placed near the radiant tubes to prevent overheating of the alloy tubes, and two thermocouples are located on the outside and inside of the charge. Temperature differentials are within 10 degrees throughout the charge. The quality of malleable iron is on a par with that produced by any of the best furnaces in the industry."

Continuously Charged Cupola Eases Labor Stringency

James H. Lansing, consulting engineer, Malleable Founders' Society, Cleveland: "In 1944, while producing something over a million tons of malleable iron castings, this industry has concerned itself principally with the maintenance of standards of quality and production in the face of a decreasing labor supply.

"In many plants, molding labor has been reduced by the greater use of sand handling equipment and mold conveyors which require a continuous molten metal supply. This has generally been attained by utilizing a cupola, which may be continuously charged and tapped, as the original melting medium. Metal is run directly from it into an air furnace where refinement, a mixture of what otherwise might be somewhat variable batches, any necessary correction of composition, and superheating are accomplished. Monorail systems facilitate pouring.

"For annealing, some additional continuous ovens have been installed but portable batch type radiant tube ovens have been a 1944 development in the malleable field. These ovens well adapt themselves to the annealing of large rear axle housings which are stacked on hearths some 12 feet wide by 18 feet long. Thirty-ton cranes then are used to place the gas-fired radiant tube bottomless ovens over the hearths. The anneal is completed in about 72 hours and the ovens removed.

"Many plants, especially those of medium or relatively small size, or ones not having large quantity orders for individual parts, have not found it advantageous to install conveyorized molding, sand handling or duplex melting equipment. Many of these have, however, introduced further efficiency into their handling methods by the use of lift or other industrial trucks, for handling furnace charges, handling sand and castings in the foundry, and in general throughout the plant. Many have also installed monorail cranes for molten metal handling and for the handling of annealing, and other containers.

"To further quality control, the Malleable Founders' Society has established its laboratory in Cleveland. There, the work of the well qualified technical organizations of member companies is supplemented. Shop-practice engineers make regular field visits to the plants, sending in specimens for test and metallurgical examination. As an aid to all interested in malleable iron, 'American Malleable Iron—A Handbook,' first handbook on this subject, was announced by the Society, in December."

Better Command of Stress Distribution To Be Helpful

Oliver Smalley, president, Meehanite Research Institute of America Inc., New Rochelle, N. Y.: "For the foundries of the country, 1944 was a complex year combining progress and development with all the grievances created by a truly acute manpower shortage. That the progressive strides forward should be as numerous and fruitful as they have been is a tribute to both labor and management, and serves to point the way to a future brighter in many respects.

"The past year has emphasized one serious and growing danger with regard to future manpower conditions. The foundry industry seems to have failed to sell itself as an industry attractive to new and young labor and to the college graduate. Foundry apprentice activity is unhappily small and the industry and its various associations should formulate and support programs designed to promote growth on a sound basis.

"On the brighter side, changes in engineering attitudes toward iron castings and their applications have been frequent and beneficial. There is no longer a scarcity of true knowledge concerning the engineering advantages to be had from the proper design and application of high duty and superior property irons such as Meehanite; thus the recorded experiences of our wartime industry is already proving to be of great value to the engineers, designers and those whose responsibilities involve the selection of materials and product design. The membership of the Institute has been particularly active along these lines, correlating and making available service records and performance data as compiled by over 100 licensed foundries here and abroad.

"Paralleling increased study and understanding of methods providing quality control in manufacture, have been equally important researches in the behavior of castings under the varied conditions imposed upon them. Perhaps one of the most important was concerned with casting designs which will allow a proper distribution of stresses. Some progress has been made in the understanding of the action of fatigue and work has been done on creep properties which has been most helpful.

"From a product standpoint the important fact is that literally thousands of tons of much needed steel, bronze and alloys have been conserved and made available for other uses through successful application of Meehanite castings."

Desirable Characteristics Attained with Permanent Mold

Edward C. Hoenicke, assistant to general manager, Foundry Division, Eaton Mfg. Co., Detroit: "The permanent mold process to produce gray iron castings has progressed well beyond the stage of development to where it is today a recognized foundry method. It is rapidly gaining favor for a wide variety of gray iron castings where high strength, a dense, homogeneous structure without porosity, and free-machining characteristics are desired.

"Metallurgical developments—particularly in the field of alloys to increase mold life, better machine design for opening, closing, and cooling the molds, together with improved mold coatings and a better understanding of the quick cooling characteristics of gray iron poured in permanent molds—portends better production and improved physical and mechanical properties.

"The quality of permanent mold gray iron castings has been graphically demonstrated during the war due to their ability to replace many brass and bronze forgings and castings for which no material was available due to limitation orders. They can be used with distinct advantage in industries producing diesel engines, automobiles, trucks, tractors, refrigerators, washing machines, air conditioning units, valves, hydraulic controls, and many other products.

"New developments for ordnance purposes together with new fields opened up by research and by substitution of permanent mold gray iron for other materials would seem to indicate a postwar production of over 50,000,000 of these castings annually."

Rate of Freezing in Molds and Sand Temperatures Key Factors

H. A. Schwartz, manager of research, National Malleable & Steel Castings Co., Cleveland: "The most significant trend at the moment in the foundry industry is the increase of interest in the principles of physics which have to do with the rate of freezing of metals in molds and the temperatures reached by molding sand. Up to quite recent times the foundryman proceeded purely by guess in his efforts to make a casting freeze in such a manner that feeding would be successful. In a number of places, and more particularly under the auspices of the American Foundrymen's Association, the principles of heat transfer which govern what should be done are now receiving systematic attention. This trend may well ultimately make a science out of what was previously only a craft.

"A second problem, more metallurgical in character, is that it is now being found necessary to study the graphitizing reaction even in rather low carbon steels, since graphite formation has been found of commercial importance in super-heated steam lines where temperatures are maintained over many years. This problem is being energetically studied, but no complete clarification has as yet been reached."

Availability of Inoculants To Ease Problems of Control

R. G. McElwee, manager, Foundry Division, Vanadium Corp. of America, Detroit: "In no period in the history of the gray iron industry has there been in evidence such a real desire for better products than during the past few months. Strict specifications have made it necessary for all producers of gray iron to adopt control and processing treatments, insuring more certain repetitive results. That standards could be raised in spite of difficulties in securing exactly the type of raw materials, particularly scrap to which the producer has been accustomed, is a real tribute to the ingenuity of the founddryman.

"No small factor in the success in this field in meeting higher and higher standards has been the availability of inoculants, or ladle treatments, the effect of which is to ease the problem of control and repetition. No doubt, the present wide use of these new tools will be extended as producers have an opportunity to study their possibilities."

Centrifugal Casting of Cylinder Sleeves Seriously Considered

Garnet P. Phillips, chief metallurgist, Automotive Foundries, International Harvester Co., Chicago: "There have been no radical changes in melting equipment used to produce metal for automotive gray iron castings. The cupola is, and will continue to be, the important melting unit for the mass of gray iron. Electric arc furnaces have found their place as the melting units to produce lower carbon and the higher alloy irons.

"Hot blast equipment for cupolas in foundries with sufficient tonnage to justify the investment involved continue to find increasing application due to lower melting costs and better cupola operation.

"Late additions of inoculants to all types of gray irons is finding increasing favor as a means to better control of chill and various physical properties. This practice, along with judicious alloying, tends to simplify melting problems as one base iron can be made to serve for a variety of types of castings.

"Laboratory control of molding and core sand properties, both at room and elevated temperatures, is being increasingly applied. There is a better understanding of properties needed and a continuing improvement in the control of these properties. The use of core blowing equipment continues to increase with more accurately made cores and increased production resulting.

"Centrifugal casting of cylinder sleeves and liners has received serious consideration and some increased application. Large scale application will depend on whether superior properties can be developed and lower overall production costs obtained as compared to the best static sand casting methods. Both of these factors remain to be demonstrated.

"There has been increasing application of stress relief heat treatment for dimensional stability and annealing where both stress relief and increased machinability are needed. Considerable experimental work is being done on hot quenching heat treatments and hardenability properties of gray irons.

"The future of the automotive gray

iron foundry industry was never brighter. This belief is held with full recognition of developments in the fields of light metals and plastics."

Ordnance Specifications Will Influence Materials' Standing

J. Erler, chief metallurgist, Farrel-Birmingham Co. Inc., Ansonia, Conn.: "Gray iron foundry capacities have not been increased on a scale similar to that found in other fields of either ferrous or nonferrous metals. This has been largely because as an engineering material it has played a less important role in this war than in World War I.

"On the other hand, a wide variety of gray iron compositions, particularly in the high-strength group, which were mostly developed prior to the outbreak of the war, were given an opportunity to prove their merits due to the shortage of critical materials. A number of compositions have not only proven themselves to be good substitutes, but in many cases even better engineering materials than those previously used. In those fields of design engineering, where a combination of strength, notch sensitivity, and damping capacity have an important influence in the selection of the product, gray iron castings should have an excellent future in applications not commonly known before the war.

"Present conception of Ordnance specifications will have a profound influence on the postwar evaluation of all materials. Even though large strides have been made in the correlation of the physical properties of test bars with those of the castings proper, it will be essential that in the near future more conclusive data be made available to the engineering profession, if this industry intends to be recognized as producing an engineering material of known value. This, in combination with manufacturing methods which assure consistent properties in the casting, will greatly further application of gray iron.

"Development, which was speeded by the present emergency, in combination with its normal capacity, should give the gray iron industry an excellent opportunity for peace time service in many new and old fields, despite the advanced processes of welding and the light metals and their alloys which will be strong competitors in many old markets of gray iron foundries."

Known Qualities of Zinc Alloys Insure Reacceptance

R. Davison, manager, Market Development Division, New Jersey Zinc Co., New York: "There has been much discussion in recent months concerning the competition between the various die casting metals in the postwar period. However, these discussions have principally revolved around their relative postwar prices as being the sole determining factor. There are many other factors which must be considered if we are to properly evaluate the future extent of use of die casting metals.

"As in the past, the selection of alloy for a given die casting application will depend on the following considerations more than on relative metal costs: Ease of casting; adaptability for particular uses—including physical, mechanical and chemical properties; dimensional limits which can be held; ease of machining and finishing; cost of dies, including upkeep or replacement if runs are long enough to require the latter; and overall production costs.

"These are the considerations which presage a rapid return to the preponderant use of zinc alloy die castings."

Plethora of Secondary Aluminum, Magnesium To Broaden Uses

A. D. Weigolt, Precision Castings Co. Inc., Cleveland, O.: "Due to the war, progress made in the development of high pressure aluminum castings, and also the enormous capacity of aluminum developed, is bound to have—in fact, already is having—a marked effect on postwar applications of aluminum die castings. These will be greater than ever before.

"The extremely low cost of aluminum secondary alloys will open up a market and applications that heretofore could not be touched. It should make for a great increase in the use of aluminum, along with a marked increase in use of magnesium, without in any way detracting from the postwar volume of zinc where the use of same offers marked advantages.

"The progressive engineer is well aware of the change taking place in the application of die castings and is prepared to fully utilize the advantages of these low cost metals that will be available in great volume shortly after hostilities cease."

Demand for Semiautomatic Die Casting Units Foreseen

F. W. McIntyre, president, Reed-Prentice Corp., Worcester, Mass.: "Heavy demand for the late type semi-automatic die casting machines for producing zinc, aluminum, magnesium, and brass die castings is anticipated. With the increased production of these materials, it is expected that the cost of materials will be reduced and will warrant many manufacturers to specify die castings in the future.

"There is also an increased demand for large-capacity die casting machines, and in postwar many of these machines undoubtedly will be installed in the products manufacturers' plants.

"Also anticipated is a large foreign demand for all sizes and types of die casting machines as both England and Russia have large installations operating in their war program that will be turned over to civilian use. There have been many improvements made on these machines, including increased locking pressure for the dies and increased pressures on the metal.

"Die casting machines are now available with the self-contained furnace construction as part of the machine and incorporating the vertical plunger, gooseneck construction for zinc. This furnace can be removed and the horizontal, high pressure, cold chamber construction applied for producing aluminum, magnesium, and brass die castings."

Structural Value of Die Castings Enhanced by Alloys

R. W. Dively, metallurgist, The Hoover Co., North Canton, O.: "In the past few years the die casting industry has made tremendous strides, especially in the aluminum and magnesium fields. However, aluminum die casting only will be considered here.

"From an external viewpoint, there are occurring less surface defects and blemishes. The internal porosity has been reduced to a minimum, as revealed by radiography and fluoroscopy. Along with reducing the porosity, physical characteristics of the alloys employed have been improved.

"These improvements have been brought about by the development of new die casting equipment that can produce constantly good quality castings. This equipment is of the cold chamber type so that extremely high pressure can be maintained when needed on the injected metal. Pressure varies, depending upon size of casting and type of machine. On new equipment being installed at the Hoover Co., pressures to 48,000 p.s.i. easily can be obtained on the injected metal. The use of slower injecting speeds along with increased pressure on the injected metal tends toward a porosity-free casting. The employment of shorter gates from the well to the cavity, as well as larger feeders to the cavity, has tremendously improved internal porosity.

"In the second place, new alloys have been developed with improved physical characteristics. Therefore, the structural value of die castings has been increased. It has been an objective of the die casting industry and professional organizations to stabilize the alloys to be employed. This has been accomplished to a certain degree by the American So-

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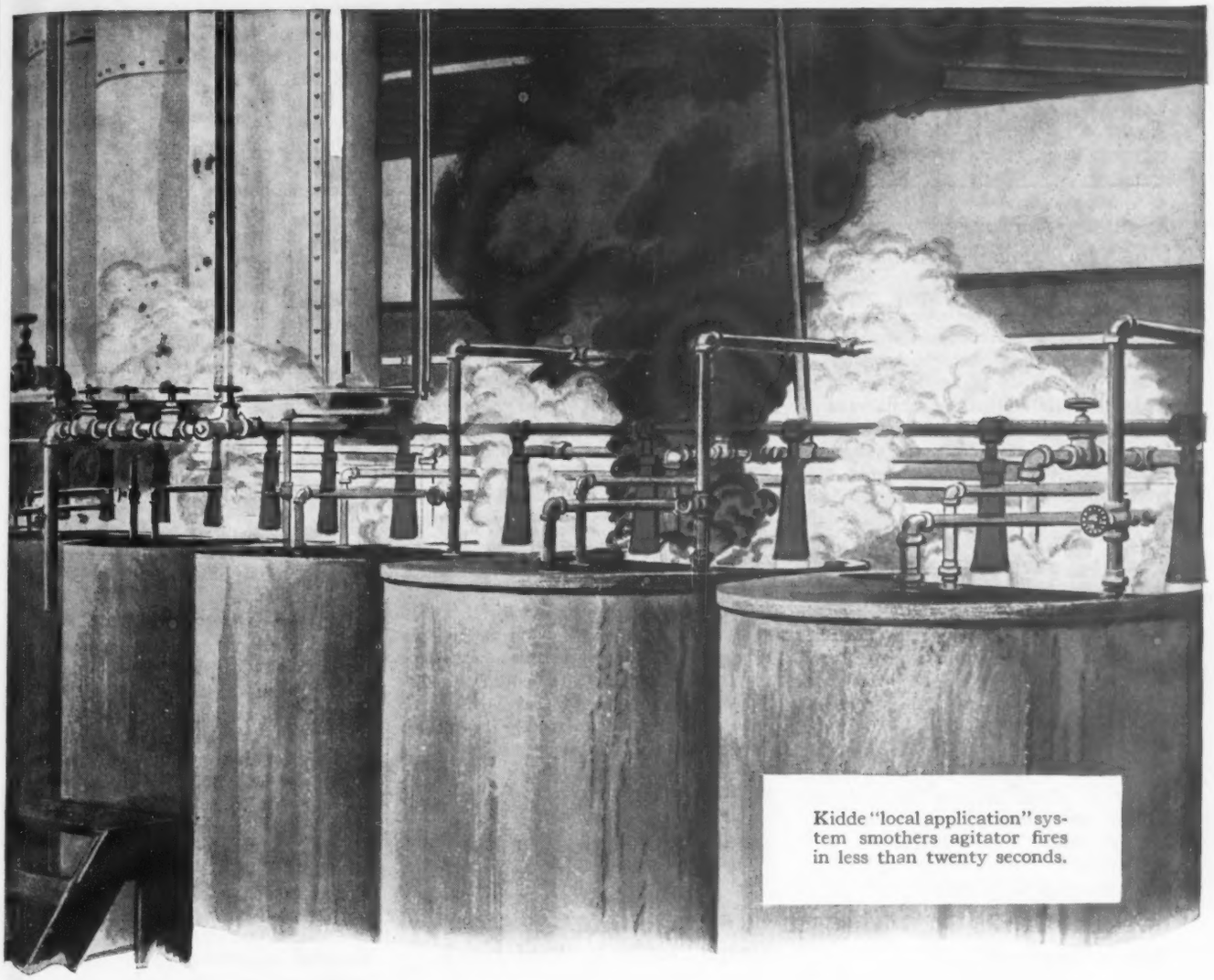

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METALLURGY

Engineers Approve Low Alloy Steels in Redesigning Parts

N. F. Tisdale, metallurgical engineer, Molybdenum Corp. of America, Pittsburgh: "Many parts formerly made of carbon steels are being redesigned to take advantage of higher strengths obtained by addition of small amounts of alloys. Specialized heat treatment is being utilized to bring out maximum strength of these new alloy steels. Molybdenum is found in many new specifications or additions made of it to old ones.

"A newcomer to the group of available alloys, boron is finding constantly expanding applications and, where it is used properly, marked satisfaction is given. Its use is very diversified, finding applications in cast iron, malleable iron, cast steels of low and high alloy, wrought steel of various analyses, including stainless.

"We see a rapidly expanding application of alloys because designers are leaving new increased figures for physical properties which heretofore were impossible to obtain except in high alloy percentages. Economy will be a predominant thought in reconstruction days ahead, and these new alloys will merit consideration."

Hardenability and Chemical Analysis To Serve Together

Arthur E. Focke, research metallurgist, Diamond Chain & Mfg. Co., Indianapolis, Ind.: "The writer frequently is asked what he thinks will be the future of the NE steels when the present restrictions on the higher alloy SAE and AISI steels are removed. It seems that it will depend almost entirely on the relative price of the NE and the higher alloy steels.

"While it is true that the medium carbon NE steels such as 9440, 8640 and even 8630 have proved quite satisfactory, not only for common applications but even on many critical jobs, it seems to be rather generally agreed that, unless a prohibitive price differential is established between these NE steels and the higher alloy SAE and AISI grades, most metallurgists will prefer to return to the older single or double alloy grades, or possibly to the higher triple alloy grades such as 4340.

"A similar comment would appear to apply to the carburizing grades also, although for these, while the NE steels were frequently satisfactory, there were many applications in which it was discovered that the substitution of an NE steel with hardenability equivalent to that obtained previously on the SAE or AISI grade did not produce satisfactory results. Also, there was a number of critical applications for which carburized NE 8620 was found to be definitely inferior and for such parts it would be difficult to satisfy the metallurgist with this steel regardless of any price differential.

"This brings up the question of the ultimate position of hardenability as a factor in the specifications for the purchasing of, and in the final acceptance of, steel. It seems probable that while for some applications it would be possible to purchase on the basis of hardenability only, for the greater part of the steel purchased for use in parts in which it is necessary to provide the ultimate possible in physical properties and uniformity, the hardenability specification will be added to rather than substituted for the existing chemical requirements."

Study Means To Check Excessive Graphitization in Weld Zones

J. W. Bolton, chief metallurgist, Lunkenheimer Co., Cincinnati, O.: "Among many ferrous and nonferrous alloy developments, that of graphitization in cast carbon and carbon molybdenum steels is of interest. Failure of a wrought carbon molybdenum pipe in an eastern central power station revealed that cause was localized and extreme graphitization at or near weld affected zone. This led many utilities to study the structures of metals exposed for long periods in their piping to temperatures usually in the range of 900 to 950 degrees Fahr. A number of castings weldments were (among other steel products) found graphitized. One of the more extensively graphitized casting weldments was subjected to a number of searching mechanical as well as structural studies. These showed relatively unimpaired tensile strength and yield point. Ductility and impact characteristics were appreciably lowered. The last remained, however, as high or higher than that of alloy steel bolting considered quite suitable for the service.

"No field failures of castings have been observed, and there is good reason to believe that even in graphitized castings, deterioration to the point of failure is a remote possibility. The occurrence of graphitization in weldments of carbon molybdenum steel aluminum killed, sometimes is a 'hair trigger' phenomenon. In the case above referred to only one end (in both casting and pipe weld affected zone borders) was graphitized.

"Careful studies indicate that the structural conditions, aside from graphitization, and compositions were the same at either end—this also was true of the pipe involved. Tentative conclusion was that, irrespective of care used in welding, welding was the variable which induced graphitization in casting (and pipe) at one end, and its absence in the other end of the specimen.

"Two approaches toward elimination of danger of graphite forming have been proposed. One is the production of material showing normal and relatively coarse grained under McQuaid-Ehn test. Silicon killed steels usually exhibit these characteristics. Silicon kill is not readily applicable to cast steels, if truly sound castings are an objective.

"The second approach contemplates retention of the many practical and engineering benefits of aluminum kill, and the elimination of graphitization possibility by means of inhibiting agencies, specifically, alloy additions. Our company has shown that the nickel-chrome-molybdenum steel ASTM-A217-WC-4 (aluminum killed) is highly resistant toward graphitization over a wide range of structures. Under conditions of their studies, regular aluminum killed carbon molybdenum is graphitized irrespective of initial structure. These severe tests extended over 6000 hours exposure to temperature of 1100 degrees Fahr. and reduced graphitization of carbon molybdenum structures as yet not shown to cause graphitization in field service at 900 to 950 degrees Fahr. This lends emphasis and assurance to the conclusion that WC-4 steel is a safe steel for usage at these temperatures."

Hardenability Bands Promote Better Grasp of Specifications

J. T. Jarman, general superintendent, Allis-Chalmers Mfg. Co., Milwaukee: "It has always been the function of the metallurgist to express physical structure of metals in terms of load carrying ability to the designer. In the alloy and low alloy steels, Jominy hardenability has provided a refinement to the past methods of presentation of data, and the metallurgist studying its application in designs requiring torsional strength, compressive strength, wear, etc. will find good data for his efforts.

"In line with the understanding of the application of hardenability, specified hardenability bands are now gradually

developing. The use of these bands should materially simplify the selection of steel products and their practical application will help the metallurgist and the designer in their mutual conclusions about the requirements of the steel in the subject design.

"Hardenability bands and their application will also continue to promote new metallurgical understanding of steel specifications.

"Precision casting has gained immeasurably in production of special war time products; and since many alloys can be cast by this method, development is certain to include many peace time products. This casting procedure is versatile in that small lots as well as production items can be considered."

Expect Further Developments From Controlled Use of Strain

R. H. Harrington, research metallurgist, General Electric Co., Schenectady, N. Y.: "Recent advances in metallurgy, advances that will continue to affect our alloy progress, are divided into two classes: Methods of fabrication—inclusive of heat treatments—and new alloys. Combinations of processes, such as the tinning of sheet steel as it comes from the rolls, will yield more and more economy.

"As early as 1939 some new metallurgical principles were set forth relative to pre-recrystallization aging of cold-worked solid solutions. During the next 3 years, technical reports described the increases in elastic properties and endurance limits, with elongation either increasing simultaneously or remaining constant, for such treatments applied to cold-rolled phosphor-tin bronzes, the brasses, cadmium-copper, etc. Two outstanding contributions of this new type of heat treatment to the war effort are the steel artillery shell, and the marked increase in elastic properties for aluminum alloy 24S—consequent decrease in dead weight of airplanes. Further developments can definitely be expected from the controlled use of strain, such as cold-working, relative to heat treatment.

"When the war is over, it may be expected that new methods will be disclosed for shaping many of yesterday's forgings directly from the melt with resultant properties at least equivalent to those of the forgings. These methods will probably be limited for some time mainly to the field of light alloys.

"Until very recently it was commonly believed that centrifugal casting of aluminum alloys, while giving some economy, yielded products of very inferior properties. Use of some new aluminum alloy compositions has shown that the centrifugal casting of such materials can yield products very much superior in strength properties to those obtained by gravity sand casting.

"Recently, some new high-strength wrought aluminum alloys, plain and clad, have been announced. It can be expected that some future announcements will be concerned with new, higher strength, more corrosion resistant, heat-treatable casting alloys of aluminum. New zinc alloys with greater creep resistance—even some mild spring properties—greater strength, greater corrosion resistance, and recrystallization temperatures in excess of 175 degrees Cent., either wrought or die cast, may also be expected. The increased production and lowered cost of magnesium should contribute some new developments of its alloys. Further developments of copper base alloys, employing manganese, may be other contributions of the near future."

Induction-Hardened Mild Steel To Replace Some Costly Alloys

William E. Benninghoff, Manager, Tocco Division, Ohio Crankshaft Co., Cleveland, O.: "During 1944 high frequency induction heating continued to advance. The year witnessed new applications and the introduction of more efficient as well as more rugged equipment.

"Marked progress in the field of forging has taken place. Aluminum is now being successfully heated for forging. Because induction heat minimizes scale formation on steel parts, renewed interest in press forging technique has been observed. A further innovation certain to benefit the forging industry is the introduction of a water-cooled high-frequency generator. As this new unit is hermetically sealed, it can be operated in the most grimy atmosphere much more satisfactorily than its air-cooled predecessors.

"The first commercial application for the continuous heat treatment of bar stock (or tubing) went into operation last summer. Here is an example of how induction is serving as an agent for through heating and providing uniformity of hardness bar to bar, and inch to inch on a given bar.

"Further evidence of new developments is the experimental work on bonding of platings. Also, the perfection of a machine for the assembly of tractor track rollers is outstanding. This unit hardens and shrink-fits the 3-piece roller in one operation where formerly five were required.

"Induction is a tool with great postwar possibilities. You will see more induction hardened carbon steels replacing costly high alloys. The process will serve wherever heat for processing metals is needed. A spectacular record of war production points to an even brighter period in the peace ahead."

Molybdenum Plays Leading Role in Hardening Process

Alvin J. Herzig, chief metallurgist, Climax Molybdenum Co., Detroit: "The selection of a composition of steel for a specific service is a vital question. It should be based on the soundest data which can be collected. Whenever any empirical data which are accumulated for this purpose can be confirmed by fundamental principles, the integrity of the selection is more firmly established.

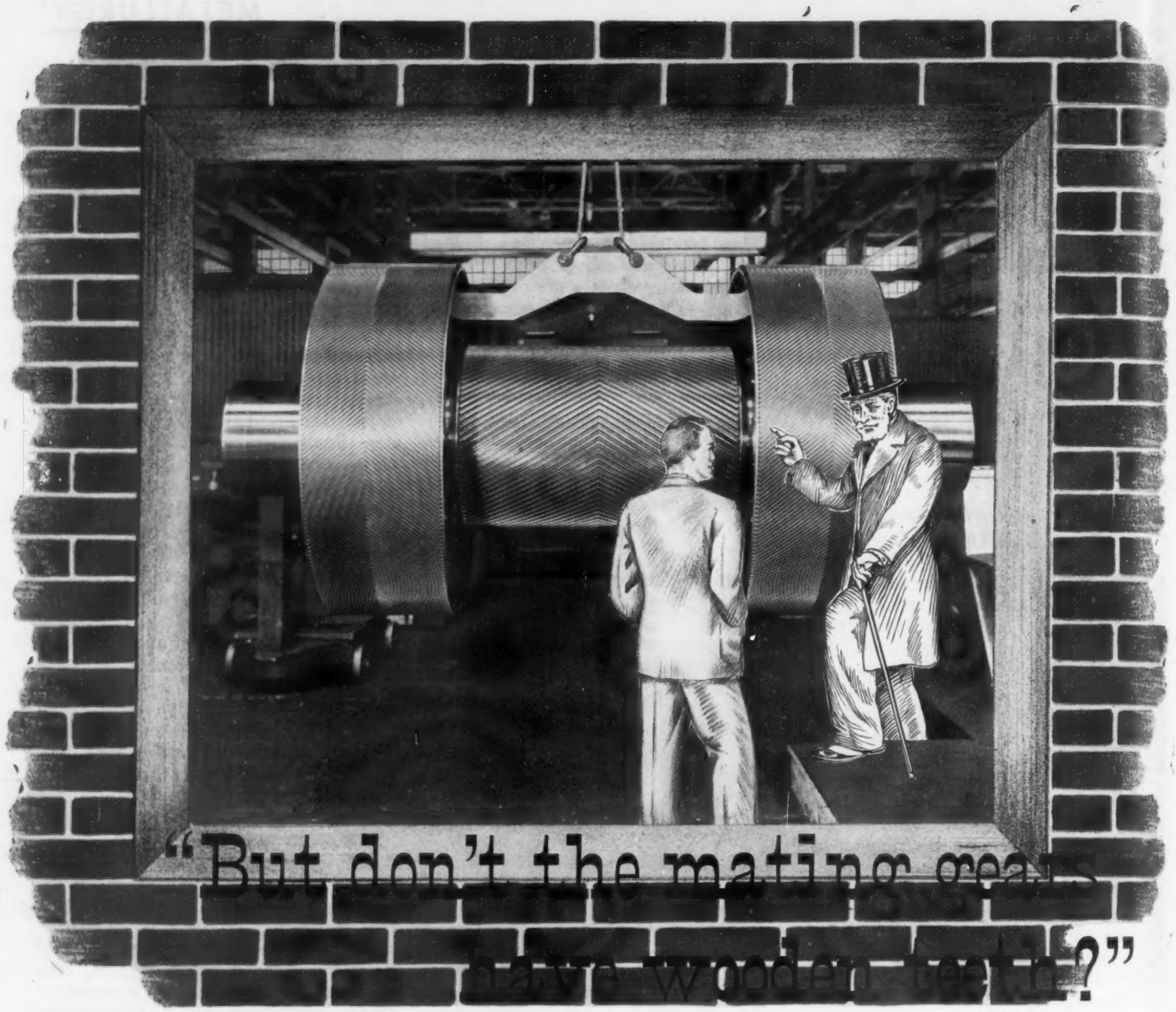
"Experience has shown that the property of hardenability in steel is, in many ways, a useful gage of the adaptability of a steel to the production methods and to the service in which the steel will be expected to perform. Hardenability depends largely on composition. Much of the usefulness of alloy steels lies in the contribution of alloys to hardenability. For this reason, an explanation of the mechanism by which the several alloying elements contribute to hardenability would be of assistance, not only to research metallurgists, but, also, to the operating metallurgists and engineers whose responsibility for the selection and appraisal of steel compositions is great.

"During 1944, research in progress at our laboratory culminated in an exposition of the role of molybdenum in the hardening process. It has been shown that knowledge of the rate of diffusion of molybdenum in iron, coupled with knowledge of the composition of the equilibrium phases in molybdenum containing steels at various temperatures, leads logically to a fundamental account of the contribution of molybdenum to the hardening process.

"Although the explanation which describes the process by which molybdenum contributes to the hardenability of steel cannot be generally applied to all alloying elements, one should look forward to a more complete and more satisfactory account of the contribution of all alloying elements to hardenability of steel through the continuation of this same type of research. It is inevitable that such work will, as it proceeds, yield further information on the other contributions made by the alloying elements in steel."

Widespread Use of Steel Simplification Endorsed

L. B. Evans, LaSalle Steel Co., Chicago: "Probably one of the most important developments in the steel industry in recent years is the definite tendency toward simplification of specifications. A great deal was accomplished along this line by the establishment of joint AISI-SAE-NE steels but still there are nearly 200 analyses, which many



A natural question to ask—back in, say, 1875.

In those days, to secure quiet operation, one member of a pair of gears was often made with wooden teeth mortised into the iron rim. A spare set had to be kept on hand at all times because the wooden teeth wore out rapidly.

But with the development of higher speed machinery, so-called mortise gears became inadequate. They were superseded by gears with the teeth machine-cut in the metal rim— fore runners of the high precision, quiet operating gears built by the thousands for the Navy, the Maritime Commission, and our Nation's vital war industries.

The difference between early machine-cut gears and the precision gears we know today is largely the result of improved cutting methods. While it is true that our knowledge of the laws governing tooth shapes has continually increased, the greatest advances in the last half century have been in gear generating machines.

Development of the Farrel-Sykes method of gear generation made possible the *Gear with a Backbone.* This unique process permits the cutting of continuous herringbone teeth, *without* a center groove. Because the two helices are joined in the center, the entire face width is put to work, providing extra strength and high load-carrying capacity in smaller space. Inherent characteristics of design, plus high precision in manufacturing processes, promote the smoothness and quietness of operation so necessary for today's high speed machinery, and contribute to increased life, continuous operating efficiency and maintenance economy.

We shall be glad to send descriptive bulletins on the Farrel *Gear with a Backbone* and the machines by which the teeth are cut, as well as information about any of the other products illustrated below.

FARREL

FARREL - BIRMINGHAM CO., INC.
ANSONIA, CONN., BUFFALO, N. Y.

Farrel-Birmingham

leading engineers feel are still far too many.

"Work of simplification done in Cincinnati is well known (see STEEL, April 29, 1944) as are the results and, of course, there are many other firms that have carried through individual simplification programs.

"Simplification means simply the use of fewer steels. It has not been uncommon for large steel users to specify as high as 20 to 30 different analyses and, in some cases, the number is even higher. Many prominent metallurgists and engineers have found that from four to ten steels will often do all the jobs required. One of the largest steel users in the Chicago district recently completed a simplification program on bar stock and reduced the number of steels used regularly to four.

"Advantages of simplification are: Lower material cost (buying can be done in larger quantities); better deliveries; simplified heat treating and inspection requirements; reduction of the 'mixed steel' hazard; and usually a better finished product."

New Applications for Boron Continue to Develop

W. B. Coleman, W. B. Coleman & Co., Philadelphia: "The past year has brought forward another test that can be made on shipments of steel in order to determine another physical characteristic. This is the Jominy hardenability test, another that can be applied to the steel to determine the hardening characteristics that a particular steel will give. One can look forward to its more rapid use in connection with specification and quality requirements.

"The spectrograph has become a more or less standard tool in many laboratories, its use being mainly for quick routine chemical analyses. However, this equipment can also be used in metallurgical investigations. Small percentages of elements may exert beneficial and detrimental properties to metal. By subjecting good and unsatisfactory material to the spectrograph, one can make direct comparison of the small amount of trace elements and see if there is any difference in the trace element composition of the two pieces of material.

"We know that boron in very small amounts, in several thousandths of 1 per cent, gives beneficial properties. Used in ferrous and nonferrous metallurgy, boron is finding successful use in many applications that were unknown a year ago.

"Another piece of equipment for inspection is the fluoroscope, used to examine metals for internal defects. Whereas X-ray gives a permanent record which can be examined by more than one person, the fluoroscope could probably be used by only one individual and the impression that he obtains on viewing would be put in the form of an opinion. No doubt the fluoroscope can become a successful tool in the laboratory, but the human element must be considered in its operation."

High Hardness—Low Stresses Aim of Molten Bath Quenching

H. Lyon Day, director of engineering control, Lehigh Foundries Inc., Easton, Pa.: "Skin stresses, as produced by shot peening, with a new degree of intensity control, in carefully calculated amounts, and in the correct direction are adding valuable life to many metal components. A hard and surprisingly flexible chromium plating likewise will add durability to metallic surfaces through corrosion protection, strength, and possibly through a skin stress exerted in the right direction.

"In the extreme opposite, we have been quite surprised to learn of the valuable aid derived from the intense stress developed through drastic water quenches used on deep hardening steels. With practically equivalent surface and internal hardnesses produced on one hand by water quenching and on the other hand by oil quenching, the high stresses developed in the first case have proven to be most desirable, especially in our direct war effort.

"Again in contrast to our deliberate search for helpful stresses first, in surface layers, and then through heavy sections in deep hardening steel, there are the increasingly popular high-temperature quenching techniques which have been of unbelievable help in ordnance production. The use of molten salt for quenching is now well-known. The end point is usually the conventional tempering, either with or without cooling to full hardening first. The object of the many salt quenching procedures is to reduce hardening stresses to a minimum, thus preventing distortion to a satisfactory degree in many cases.

"What may be considered a satisfactory degree of size and shape maintenance during hardening and tempering today can be disastrous in our economy of tomorrow. There will then be developed a method of quenching in molten baths, steels of moderate and deep hardening power, that will produce at once a high degree of hardness with a low order of stresses hitherto unanticipated. The successful achievement of this long sought goal will depend on an interlocking unity of effort of the steelmakers in meticulously reproducing heat after heat of steel to a given close requirement, with the practical heat treating metallurgist. He will use a quenchant with precisely controlled temperatures; he will use quenching periods of exact duration; and finally, he will use a predetermined rate of flush as the object is being quenched. Since no tempering will be required, the now overworked heat treater will probably save about half of his present effort for which he may find delightful use in golf or in sailing."

Creating Sound Product from Alloy Scrap Taxes Metallurgist

Wilfred H. White, metallurgist, Jackson Iron & Steel Co., Jackson, O.: "Large amounts of scrap now are available and more will become available as weapons of war are converted to the machines of peacetime production. In the supply of steel, gray iron and malleable iron scrap are the potentials of automobiles, farm machinery, washing machines and all the other equipment, which will play a part in the postwar era.

"The burden of this task will be placed on melting furnaces as swords are remelted and cast into plowshares. Due to the variety of available scrap, the melters of iron will be able to get any chemical or physical characteristics desired in their products. Sound metallurgy is required if the product is to be superior to the scrap from which it came. This is not an impossible task; foundrymen and steel men have the process well under way even now.

"During this process of reconversion, silicon and manganese are required to deoxidize heats of steel and to replace quantities of these elements lost in the cupola. Silvery pig iron, which contains quantities of both of these elements, is the leaven which will make the loaf palatable to a peaceloving world."

Quality Characteristics Are Vital in Specifying Steel

W. G. Bischoff, executive engineer, Timken Roller Bearing Co., Canton, O.: "The past few years have witnessed a trend from the old conventional methods of specifying steel requirements to more modern methods which, in addition to the chemical requirements, also include certain quality characteristics. Of the latter, hardenability is one of especial importance.

"No longer does a specification for chemical composition only provide a sufficient foundation upon which to base the purchase of steel to be used for the more critical applications. We have learned that steels of varying composition, while still well within a specified analysis range, do not always react similarly in their response to heat treatment. The need for an accurate measurement of this quality in a steel has been recognized for some time.

(*Please turn to Page* 378)

POWDER METALLURGY

Progress in Carbides Fosters Use as a Design Material

K. R. Beardslee, vice president, Carboloy Co. Inc., Detroit: "Cemented carbide, when it made its initial appearance in industry, did so as a wear resistant metal. Although output and use of cemented carbide metal has been vastly increased during the past few years, the unprecedented war demands for it in the form of cutting tools and drawing dies has tended to obscure its potential use on a far greater scale: As a 'product material' like steels, glass, nickel or plastics.

"Although achievement of carbide's full potentialities as a design material for peacetime products still lies in the future, sufficient work has been done already to make it safe to forecast that its use in the field of wear resistance may dwarf its use as a metalworking material. Included in the list are such applications for carbide metal as liners, plates, sleeves, bushings and bearings, and a large variety of parts of specialized design. Prime reason for its popularity is the decline in cost of carbide metal resulting from increased production.

"Already, carbides are proving effective in minimizing wear even under extreme conditions. Typical examples are the application of carbide liners to brick molds and molds used in powder metallurgy; grinder parts for the fine grinding of paint pigments and other abrasive materials; guide rings in wire stranding machines; etc. Of tremendous importance is the experimental work now being conducted with carbide as a bearing material—both for sleeve type and ball bearings. In some instances, a carbide shaft has been run in a carbide journal with truly astonishing results.

"Carbides are being found equally economical where only mild conditions of wear exist, such as in the manufacture of 'Jo' blocks; indicator points; meter fingers and lathe and grinder centers. Frequently, parts exposed to wear—whether conditions be extreme or mild—are subjected simultaneously to other conditions which tend to accelerate wear. Here, the combination of uniformly high hardness, strength, and great resistance to various types of wear of carbide metal together with its generally good resistance to certain forms of erosion and corrosion, has served to materially prolong the life of equipment when used in the form of valve seats; nozzles for spray painting, etc.

"Economies which can be generally realized by incorporating carbides into product design cannot be evaluated easily at this stage of its utilization. However, now that carbide metal is available in large quantities and at a cost per pound one-twentieth of what it was 15 years ago, it has already become a question in many cases whether it will not be cheaper in the long run to make an entire part out of carbide rather than of some other metal 'protected' by carbide inserts or liners. In fact many small parts already are being made of solid carbide."

Molding, Sintering of Complex Magnetic Parts Significant

Claus G. Goetzel, American Electro Metal Corp., Yonkers, N. Y.: "One of the most recent developments in the field of powder metallurgy concerns the molding and sintering of soft magnetic parts of various complicated shapes, mostly for direct current applications.

"Pole pieces with one or more curved faces and rotors with several step-like projections have been manufactured from pure carbon-free iron powders in production rates approaching 1 ton a day. The process involves a simple low-pressure molding of the powder into preliminary shapes whose density does not exceed 75 per cent of the theoretical density of iron.

"The shape of these preliminary forms is of such nature as to facilitate further operation and to lead to an ultimate high and uniform density throughout the cross-section of the part. The preliminary shape may be considerably different from the contours of the final product. A high-temperature sintering operation consolidates the porous structure and makes the metal sufficiently ductile to yield under high pressure in a coining operation, whose purpose is to form a substantially dense part in its final shape.

"The extremely strain hardened structure, which in some cases has undergone a cold reduction of 2:1, is advantageously recovered by a low temperature hydrogen annealing treatment. For optimum magnetic permeability and minimum eddy current losses, annealing is combined with a second high temperature sintering.

"The industrial development of this process, which, except for a few minor finishing operations, does away with all machining, thus saving tons of scrap metal and untold manhours, has required most modern equipment for pressing and sintering. While the new sintering furnaces used in this process provide an extremely pure atmosphere which is neutral against carbon, the molding of some of these parts has been accomplished with new quick acting presses providing complicated motions for a variety of simultaneously moving punches."

Price of Metal Powders Used in Electronics Field No Object

Charles Hardy, president, Charles Hardy Inc., New York: "Nineteen hundred and forty-four was a year of traditional development in the application of metal powders. The number of powders called for and produced has increased with the new applications found for this comparatively new art. Not all applications present volume as expressed in the form of hundreds of thousands of pounds of powder, but the importance of some of the powders while quantity is small is such that price is no object. In such cases, the purity of the powders plays a much greater role than the value, particularly in the electrical field—in electronics, X-rays, radio, radar, etc.

"The large consumption of metal powders is still in the field of bushings and bearings, or perhaps better expressed in antifriction and friction-material production. Machine parts made from combinations of various elements where production can be speeded up and manhours saved probably comes next in line of importance.

"The number of applications which heretofore were classified as 'can't be done' is getting smaller and smaller.

"Nineteen hundred and forty-five should, based upon the research and development work done in 1944, show further growth of this industry."

Diffusion Alloying of Powders During Sintering New Project

W. N. Pratt, research engineer, Powder Metallurgy Corp., Long Island City, N. Y.: "Recent developments in the field of powder metallurgy have led to the production of more complex parts of better physical properties. Alloy powders which have been hard to fabricate are being developed with characteristics which makes the pressing easier. Other alloy powders that are available in production quantities are in the experimental stage.

"Better presses and better powders are leading to better physical properties and a committee has been formed to specify tests which will determine the physical properties of various types of powder metal products, so that engineering data can be used in design work. New products of high density and good physical properties have become commonplace.

(*Please turn to Page* 382)

MACHINING

Postwar Machine Tools Will Reflect War Experiences

Joseph L. Trecker, vice president, Kearney & Trecker Corp., Milwaukee, and president, National Machine Tool Builders' Association: "Most of the really important engineering developments in the machine tool industry, arising out of war experience, have not yet been translated into new models.

"Obviously, there has been a tremendous increase in the use of new processes, such as honing and broaching, and a marked extension of our facilities for milling and grinding. The really striking developments, however, are still 'in work' and will not be announced until the machine tool builder has completed his war task.

"The fact is that machine tools are normally in a constant state of redesign. No sooner has a machine been developed and tooled-up for sale to the metalworking industries of the United States than the manufacturer begins to think up ways and means in which that machine can be made more accurate and safe and more productive. I know of no industry in which the process of redesign and improvement is more constantly in mind than the machine tool industry."

Mist Lubrication Method Adds To Machine Tool Efficiency

W. E. Whipp, president, Monarch Machine Tool Co., Sidney, O.: "The ever increasing higher speeds required of machine tool spindles for machining of light metals has prompted extensive development work to insure prolonged life and accuracy of the spindle mounting so that dimensions and surface finishes close to perfection can be obtained. The company's experience has been that bearing mounting and lubrication are of prime importance when attempting to reach these objectives.

"The difficulty, however, which has had to be overcome when going into higher operating speeds is to dissipate properly the heat which is generated. To accomplish this, our engineers have developed a method of oil-mist lubrication. In this process a very small quantity of clean, filtered oil is injected into a stream of air. The resulting oil mist is directed into the bearing housing, works its way through the bearing under pressure and ultimately escapes, partially through an exhaust port and partially through the bearing enclosures.

"The result is perfect bearing lubrication without waste of oil and with but slight increase over room temperature. While the air which accompanies the vaporized oil into a lathe headstock, for example, may have some cooling effect, the low operating temperature achieved is attributed more to the very minute quantity of oil which is used.

"This means of lubrication is also being applied to high-speed gearboxes with equally favorable results."

Machining at 20,000 Feet Per Minute Done in Hypermilling

Malcolm F. Judkins, chief engineer, Firthite Division, Firth-Sterling Steel Co., McKeesport, Pa.: "The news about sintered carbide tools this year is war news and good news! From every war front comes news of the abundance and excellence of our combat materiel. This is more than ever before a war of metals and metalworking machines. Equipment and mechanisms are never wrought into final form direct from castings, forgings, stampings or drawings. Every minute piece down to miniscule gears for aircraft instruments must feel the magic touch of the toolmaker and the machinist. Neither accuracy nor precision are ever accidents. Efficient, smoothly running mechanisms represent hours of careful machining.

"Sintered carbides are the indispensable ingredient in the formula for successful warfare because tools tipped with them:

1—Cut faster
2—Last longer
3—Remove metal most rapidly—up to 1000 pounds per hour
4—Multiply the productivity of workers and machines
5—Conserve vitally strategic materials by reducing scrap
6—Make equipment improvements possible by permitting
(a) heat treatment before machining—eliminating distortion
(b) use of stronger alloys, harder, tougher armor.

"The most outstanding achievements of sintered carbide tipped tools are in the field of hypermilling. Breech blocks and rings for cannon as well as gun mounts required long hours of milling by the older methods. Hours become minutes through the superspeeds employed in hypermilling. Feeds (rate of work travel past the cutter) range up to 40 inches per minute even on hardened steel. Heat treated, high-strength (highly alloyed) steel parts for retractable aircraft landing gear are speedily finish milled to close limits by the hypermilling method. Heat treated aluminum alloy cap spars (wing cantilever beam members) are machined by the hypermilling technique at speeds exceeding 20,000 feet per minute and feeds up to 240 inches per minute.

"The exigencies of war have taught us to realize the full benefits of sintered carbide tipped tools. When peace comes and the emphasis swings again away from speed to economy of production the lessons we have learned will enable us to produce the wares of 'an economy of abundance' at a price which all can pay."

Machine Eliminates Separate Operation for Pointing Bolts

C. N. Kirkpatrick, president, Landis Machine Co., Waynesboro, Pa.: "Any emergency, brings forth the best in people. World War II being a most tragic emergency, is no exception. It threw a challenge to industry, which responded in a manner so as to amaze the entire world with its increased production and technological improvements.

"Machine tools, the basic tools of industry, led the way in this great production of war components. Cutting tools played an equally important part. Machine tools for the postwar period will embody many new features in design which will result in increased efficiency, improved production, and what is more important, in lower manufacturing costs. Again cutting tools will play an equal part with their new designs and metallurgical improvements.

"As manufacturers of machine tools and cutting tools, we are developing new designs in both lines. We will have to offer an automatic combination rolling and pointing machine. There has never been such a machine placed upon the market before. It will eliminate a separate operation for pointing bolts, screws, studs, etc., and operation will cost practically nothing. Other new machines also are being prepared.

"New Landis die heads, collapsible taps and a distinctive design of chaser will also be offered in the postwar period. Extensive experimental and development work along metallurgical lines have already resulted in long tool life and higher cutting speeds.

"Generally, machine tools and cutting tools will be manufactured having in mind the great importance of reducing manufacturing costs. During the war period, costs have been given very little thought. In the postwar period, however, manufacturers are going to install new equipment only if it can be shown that costs may be reduced considerably. It is only by expanding the market with

ANNOUNCING

A Revolutionary

Model 18-43 "Shear-Speed", designed for gears and splines up to 4 in. diameter and 2 in. face width.

WITH THE MICHIGAN "SHEAR-SPEED"
(TRADE-MARK)

New Method of
GEAR CUTTING

Designed for quantity production of gears, the Michigan "Shear-Speed" represents the first major advance in almost half a century in the roughing and semi-finishing of spur gears, helical gears, straightside splines, involute splines, shoulder gears, etc.—all of which the "Shear-Speed" will handle interchangeably.

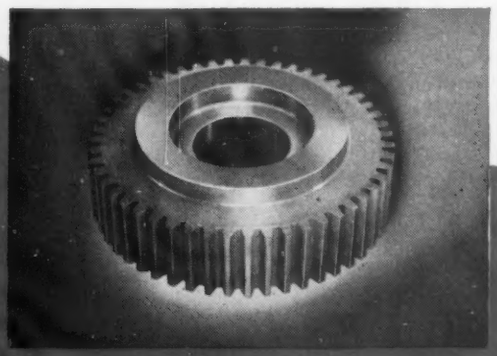
It represents the fastest, lowest cost method of cutting such gears ever developed. One "Shear-Speed" machine will rough cut all the gears that can be shaved on a rack-shaver—i. e. from 60 to 100 pieces per hour.

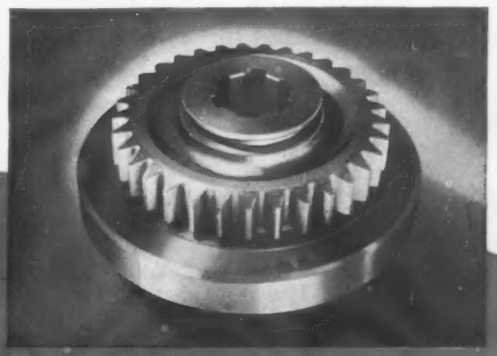
With the "Shear-Speed", all teeth of the gear are cut simultaneously. Cutting pressures are balanced in all directions, assuring concentricity. Correct spacing and form, built into the tooling, is virtually independent of machine action. Tool sharpening is extremely simple.

Shear-cutting action gives fine finish, eliminates undercut at root in gears and splines. Cutter head assemblies are installed and removed as a unit.

The "Shear-Speed" is easier to load. No arbors or nuts to worry about. Safer to operate. Easier to maintain. Automatic in operation.

Ask for Bulletin SS-44





(*Above Left*) It takes less than 1 minute to cut this 4 in. diameter, 1 in. face width, 51 tooth gear by the "Michigan" method.

(*Above*) Shoulder gears like this are no problem to the "Shear-Speed". It will turn them out just as fast as other types.

(*Left*) Helical gears can also be cut on the new Michigan "Shear-Speed" gear shaper.

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS ROAD DETROIT 12, U. S. A.

lower cost goods that we will be in a position to compete with foreign countries and provide the millions of jobs required for returning veterans and ex-war workers."

Negative Rake Milling Makes Machine Redesign Necessary

By James Y. Scott, president, Van Norman Co., Springfield, Mass.: "Of the many significant mechanical production developments during the past 12 months, the one which seems to hold for the future of American industry the greatest potentials is the development of negative rake milling. This new method of milling is significant in that it originated on the West Coast where most of the development has taken place.

"It is now apparent that production milling machines as such will have to be completely redesigned in order that the full potentials of this new method can be secured. Phenomenal increases in production are reported every year.

"One other significant development, of course, is the general acceptance of industry of induction heating in many diversified lines. Both these developments portend lower costs and better production for the future."

Automatic Machines Speed Up Output of Accurate Gears

Marvin R. Anderson, vice president, Michigan Tool Co., Detroit: "The tremendous emphasis on the utmost in accuracy in gears for war materiel has brought with it major advances in gear production techniques and equipment, and may serve as a major indicator of future developments. Permissible tolerances in gear cutting tools have shrunk to a minor fraction of those permissible in prewar years. To meet these requirements and also supply the vast number of gear cutting tools required, the industry has had to accomplish what amounted almost to a minor revolution in cutter manufacturing. Such procedures have now become relatively accepted practice and will stand industry in good stead in the years to come.

"During the year we also have seen the introduction of vastly improved equipment for the accurate finishing, in mass production, of internal gears as well as gears vastly larger and much smaller than those to which high precision equipment was previously adaptable.

"The new internal gear finishing equipment should prove of particular value if some of the trends which started before the war—to automatic transmissions, for instance—should be resumed in the years to come. It also is now possible to finish to high precision standards gears 'as high as a house.'

"At the other end of the range, small 'instrument' gears down to almost watch size are being turned out in enormous quantity by automatic and semiautomatic machines. Previously such gears were finished by laborious hand-fitting methods whenever precision was required.

"Particularly important is the trend toward greater reliance on the machine and tool rather than on the operator to produce the results desired. It is to be expected that developments in gear cutting equipment to further cut production time during roughing and semifinishing of gears in all quantities and sizes will make their appearance in due time, in line with the general trend established by the more automatic type of equipment."

New Oils Used for Cutting, Lubrication and Hydraulics

W. C. Lockwood, Technical and Research Division, The Texas Co., New York: "Cutting fluids have been and still are playing a very important part in assisting war plants in meeting schedules.

"The constant development of improved cutting fluids by the oil companies has now made available single 'all-purpose' fluids that will satisfactorily perform numerous machining operations, instead of requiring special cutting oils for each operation, which was the practice a few years ago.

"During the height of war production there arose the difficulty of maintaining the correct cutting oil in the sumps of some multiple spindle bar and chuck type automatic screw machines. Dilution of the cutting oil by the machine lubricant and the hydraulic oil is sufficient to reduce the active ingredients in the cutting oil, which greatly affects the performance of the machine and the quality of the work produced. To overcome this situation a 'Tri-Purpose Cutting Oil' was recently developed and made available that will adequately lubricate the machine, properly operate the hydraulic mechanism of the chuck type automatic screw machines, and at the same time give good tool performance on all machinery operations which are considered mild or slightly on the tough side.

"Especially prepared oils have been developed for grinding of threads. The development of thread grinders and the production of ground threads on a large scale and at low cost has opened a new field in the accomplishment of grinding operations with non-soluble oils instead of water soluble oils or mixtures. With the use of these special grinding oils a quality of surface finish heretofore unknown can be achieved on regular production schedules.

"As in the past the oil companies will continue to develop improved and new cutting fluids, keeping in step or ahead of the design and marketing of new machine tools and the adoption of new manufacturing methods so that in the future maximum production for all purposes can be secured at even lower operating cost."

Stronger Trend Noted Toward Use of Automatic Machines

George H. Johnson, president, Gisholt Machine Co., Madison, Wisc.: "The significant developments in metal working for the past year appear to be in the greatly increased demand for and interest in automatic machinery. In the earlier stages of the war, needs had to be met largely by the purchase and installation of the simplest types of machine tools. This was caused by the lack of experienced personnel, by unfamiliarity with the processing of war materials, and by the necessity of reaching peak production at the earliest possible time.

"Since the war production program has become more stabilized and the tooling up period has been entirely completed, contractors have been able to review their requirements with more care and give the time and attention necessary to utilizing automatic equipment for their work. Additionally, the opportunity for placing unrated orders for machine tools for postwar programs has further stimulated the development of automatic equipment.

"It would seem reasonable to expect that this trend towards greater utilization of the automatic metalworking equipment should continue after the war is over."

Tungsten Carbides Aid in Machining Phenolic Resins

C. E. Greenawalt, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.: "With the increased demand for melamine bonded glass based laminate, much has had to be learned about its machining properties and how it best can be fabricated. This material is more difficult to work than most other grades of micarta because it is very abrasive and cutting tool wear is rapid. Hence, tungsten carbide drills, reamers, milling cutters, etc. are recommended for use whenever possible.

"This laminate can be machined either dry or with water as a coolant. If machined dry, a very efficient dust collecting system must be used to prevent dis-

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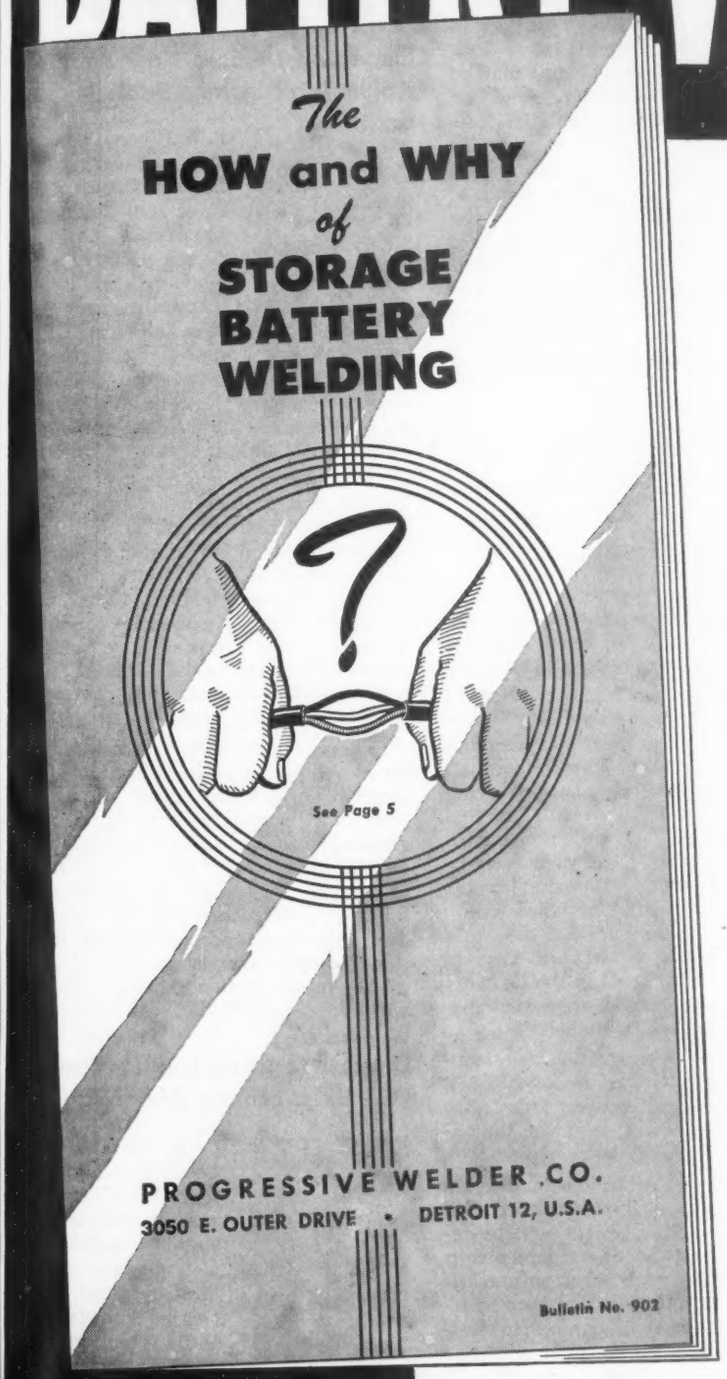

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comfiture on the part of the operator. If machined wet, especially when using carbide tools with high speeds and feeds, efficient splash guards must be used and the machines cleaned regularly to prevent the 'chip-sludge' from eventually drying and thus clogging the mechanism by caking on the moving parts.

"Experiments with a ⅛ x 16-inch diamond impregnated wheel using water as a coolant indicate that cutting feeds on a 2-inch thick melamine-glass panel can be raised from 7 inches per minute obtainable with standard abrasive wheels to as high as 40 inches per minute, at the same wheel speed of 1800 revolutions per minute."

Machining Rates Speeded Up by Heavy-Duty Tools and Cutters

Philip M. McKenna, Kennametal Inc., Latrobe, Pa.: "Milling cutters having blades of strong, hard, and crater-resistant steel-cutting grade of cemented carbide were developed in 1944 which are considered as revolutionary to the machining industry as the introduction of high speed steel 40 years ago. Slotting of airplane wing flap hinges of high strength heat treated to 43 rockwell C was done by a Milwaukee manufacturer using wedged-in tips of a strong cemented carbide. These operations were on a production basis, slotting hinges of ½ to 1½ inches wide and 8 to 10 inches long. The rate of feed had been ½-inch per minute with high speed steel cutters, but was 10½ inches per minute with the wedged-in tipped cutters. Accuracy and finish were improved. Satisfactory cutter life was obtained, the pieces per grind with carbide being 32, compared to 11 for high speed cutters.

"During 1944 a practical means of applying the economies of carbide steel milling to operations using existing machines with stepped multiple carbide tipped fly-cutters, reground, by off hand grinding without the use of a rigid cutter grinder was developed, and thousands of these were applied with success in existing milling machines.

"In the meantime carbide steel milling machines, with 50 h.p. motors, flywheels, and capable of the necessary speed, were developed by milling machine manufacturers. Face mills of 4, 6, 8, 10, and 12 inch size were developed and tested using the hard, strong crater resistant steel cutting grade of cemented carbide in solid blades, wedged-in, with double negative rake angles. As much as 1800 cubic inches of steel were removed per regrind of an 8 inch face mill having 10 teeth, or 180 cubic inches per tooth per regrind.

"Test of a carbide hob was made on large 6 pitch helical gears of steel the hob operating 9 hours continuously July 9, 1944, proving the feasibility of steel hobbing with carbide tipped hobs.

"During 1944 steel-cutting cemented carbide of $WTiC_2$ composition doubled, and pieces were further reduced, with the result that larger clamped-in pieces became economical. A line of heavy duty (HD) single point holes is being placed on the market for use in heavy cutting of steel in 1945.

"Another significant development during the past year is the application of a special grade of cemented carbide to mining tools. Carbide tipped rotary drills and undercutter bits are effecting marked economies in operating time and replacement costs. A representative case is that of drilling a series of 6½ inch diameter blast holes at the rate of two feet per minute for a total depth of almost 1000 feet in hard shale matrix having large limestone nodules, without resharpening the drill bit. Outstanding results have also been achieved with undercutter bits in such hard minerals as Langbeinite ore, and lignite coal, even when a petrified log was encountered in the cut."

Tool Engineering To Play Big Role in Reconversion

O. W. Winter, vice president, Acme Pattern & Machine Co., Buffalo: "One of the most gratifying by-products of this war aside from the many marvelous scientific and medical discoveries is the development and distinction of an extremely important but relatively unknown group known as the Tool Engineers. The tool engineers through their own professional engineering society have succeeded in some measure to focus credit for the marvels of mass production where credit belonged. Today America and the world know what tooling is, what it involves and what it does. Tools in the layman's vocabulary now extend somewhat beyond a hammer and a wrench.

"With victory nearer, the tool engineer must again do the impossible. It will be his job to rereconvert industry to peacetime pursuits and minimize the anticipated sharp transition unemployment.

"With this and after this he faces a stirring challenge. It is conceded that much of the raise in wages will be retained, that postwar direct labor costs per hour will be greater than prewar. If we are to avoid inflation, if we are to receive dollar values comparable to postwar, if we are to avoid inhibitive squeezes on profit we must produce with less effort. We have, we hope, passed through the crackpot stages of the late thirties as regards the attitude toward the machine. We have, we hope, learned that true prosperity is founded on more production with less effort. To do this we must have better and better tool engineering.

"The tool engineer, the man who has to do with the creation, and application of the means of mechanical production whether his title be president, vice president, factory manager, master mechanic, process enginere, tolo designer or what, has a keystone role in the future prosperity of America and the world. As one who has watched and participated in the professional growth of the tool engineer it is most gratifying to witness the progress that has been made."

Inspection Devices Now Being Applied to Machine Tools

R. S. Elberty, consulting engineer, New Britain, Conn.: "Machine tool design has progressed to the point where automatic machining of practically any machine member is now possible. Progress in machine design has reduced the labor cost of machining and in many cases we have learned how to make the part without machining it at all.

"This reduction in the cost of producing the part focuses more attention on other costs. For example, one bearing maker has noted an alarming increase in the cost of inspection during the past year, an increase of about 40 per cent. While this is partly caused by conditions of closer limits, overtime pay, and the use of relatively unskilled help, there is a growing demand for devices to reduce inspection costs.

"There is no universal answer, but the development and application of inspection devices directly on the machine tools has worked out well on some grinding machines, and this might well be expanded to other types of operations. Inspection devices should be designed for the convenience of the operator. And, where the production will justify the development expense, a broad application of inspection sorting machines will probably follow."

Lessons Learned During War Will Help Tooling After War

C. R. Harmon, Jessop Steel Co., Washington, Pa.: "Tempo of present wartime operations and intelligent pooling of ideas have resulted in increased knowledge of cutting tool performance. Conservation of cutting tools and emphasis on proper use and maintenance have brought out facts which will be incorporated into the postwar program.

"Cutting tools in general are of three types—high-speed, cast alloy, and carbide. Each has a field in which its performance is superior, and any attempt

(*Please turn to Page* 382)

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(3) Less manpower required.

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FORGING

Forging Metallurgy Faces Smaller Variety of Metals

Waldemar Naujoks, chief engineer, Steel Improvement & Forge Co., Cleveland, O.: "The critical need for production forgings for the war effort, a need that will continue until all the Axis partners are defeated completely, permits only a general consideration of the use of forgings in postwar design and the application of advances in forging technique to peacetime products. When the many new and important developments in forgings and forging technique can be revealed, it is certain they will offer a greater field of usefulness in the design of tomorrow's products with a greater variety of applications than ever before.

"The heavier service stresses and the greater variety of uses to be given postwar equipment and the improved efficiency required, will lead designers to consider lighter weight, specific design for service applications, exacting heat treatments, minimum of machining, and the rugged reliability of forged parts for predictable and unpredictable stresses for service on their designs.

"Advances in forging metallurgy have indicated a reduction in the variety of forging metals and alloys for a greater variety of service applications. More closely controlled heating and heat treating cycles are contributing factors. Improved structural design, positioned fiber structure, and vastly improved forging equipment and technique have opened possibilities for producing parts as forgings that were considered impractical or impossible just a few years ago."

Postwar Hammers Will Incorporate New Features

Macdonald S. Reed, chief engineer, Erie Foundry Co., Erie, Pa.: "The past year has been one of steady production at a high rate but without the frantic pressure for early delivery that has been characteristic of a few previous years. With their expanded facilities, manufacturers of forge shop equipment are in good position to make early delivery of their products and backlogs are down to the point where the longest deliveries now quoted are governed by available deliveries of motors and control equipment for board drop hammers. Shipments have been about equally divided between domestic and foreign customers, with the latter tending to be predominently lend-lease material.

"In the domestic field the requirements of the large specialized shops, such as those making aircraft forgings, for example, now have largely been met and shipments are scattered over a wide field. Inquiries and orders hold up very well. A great deal of this is for replacement of worn-out equipment, which could not be undertaken during the rush of high-priority business, and some of it is in connection with equipping for postwar business.

"Manufacturers and designers have not had opportunity for a number of years to do much development work except to meet specific needs. It is believed that new designs in several types of forge shop equipment are being made ready, and some of them are past the blueprint stage. No doubt in the postwar period there will be a great number of used hammers on the market but the impact of this on the manufacturer may be offset to a considerable extent by features that will be available only in new machines."

War Schedule Calls for More Heavy-Duty Presses

F. G. Schranz, divisional vice president, Baldwin - Southwark Division, Baldwin Locomotive Works, Philadelphia: "War requirements for large, heavy parts such as propeller shafts for ships have resulted in the construction of an increasing number of heavy-duty forging presses.

"For instance, just prior to the Japanese attack, the Navy purchased a 1000-ton press for the Pearl Harbor Naval Base which forging press is the largest of its type used by the Navy and equaled in capacity only by those in some East Coast plants.

"Weighing 260,000 pounds, the press when set up rises 34 feet above the floor level, extends 10 feet below floor level and is set on a base extending down to 25 feet below the floor. The press is of the C-frame type and powered by a 200 horsepower motor, connected to two variable pressure radial multiple cylinder hydraulic pumps.

"The outstanding feature of this press is that the operator can control the movement of the forging ram by means of a pushbutton attached to flexible cable so that he can control the forging work when standing away from the machine and near the men who are handling these long forgings under the press. A similar press has been installed at the Puget Sound Navy Yard. However, this press, in addition to the 1000-ton vertical ram, also is equipped with a 600-ton horizontal ram, thus increasing the scope of work which can be done on such a press.

"Based upon war experiences, it would appear that hydraulic presses of the heavy-duty type will find increasing applications in the fabrication of peacetime products."

High-Speed Presses Combine Rigidity and Accuracy

R. H. Jones, National Machinery Co., Tiffin, O.: "One of the most far-reaching developments in the postwar forging field will be the wide application of the modern high-speed forging press. Developments in this field, brought about as a result of extensive application of these machines on war work, have opened up almost limitless possibilities for their use in the mass production of low-weight, minimum-finish, precision-forged parts in endless variety for civilian needs.

"Presses of this kind now weigh from 32,000 pounds to 800,000 pounds. Radical improvements in design have resulted in greatly increased rigidity and much more accurate alignment. As a result, die detail is filled with a minimum of flash and die match is perfect. Positive, high speed ejection of the work from the die aids in prolonging die life and increasing output.

"While the importance of these improvements should not be minimized, they are, however, far overshadowed by the greatly increased speed—over twice that of their prototypes. Because hot stock processed at extreme speeds is in contact with the die a shorter period of time, the die life is also improved. A material increase in output—two or three times previous production—is another marked advantage of this increased speed.

"Add to these important considerations ease and convenience of feeding and freedom from production delays for excessive repairs and adjustments, and it becomes apparent that the oustanding war record of the modern high-speed forging press is only preliminary to that which it will establish on peacetime work."

Parts Pool Order Cuts Hammer Break-Down Time

E. C. Clarke, president, Chambersburg Engineering Co., Chambersburg, Pa.: "At no time has it ever been so forcibly demonstrated to the thinking engineers that conservation of manhours is the life-saving American forte, as during these last few years of war, when the U. S. has been called on to meet not only her

(*Please turn to Page* 384)

DRAWING and STAMPING

Aircraft Industry Quick To Adopt Hydraulic Presses

Howard F. MacMillin, president and general manager, Hydraulic Press Mfg. Co., Mount Gilead, O.: "During the war, the forming of sheet metal has been one of the outstanding accomplishments of the metalworking industry and one in which the hydraulic press has participated.

"The main advantage of the hydraulic deep drawing press is that parts can be turned out rapidly without wrinkling or tearing. The self-contained type of press is equipped with hydraulic blankholder and die cushion and a matched punch and die set is employed. A ring, carried by the blankholder slide holds the blank while the part is drawn.

"The aircraft industry has been quick to adopt the hydraulic press for deep metal drawing. Although such presses were used in making automobile parts, household appliances, etc., there has been no acceptance equal to that of aircraft builders and their subcontractors.

"It is logical to assume that when peacetime production is again under way, that the blankholder deep drawing press will find wide use in all sheet metal forming, embossing and drawing fields. The press handles most types of sheet metal efficiently."

Processing Innovations Endow Cylinders with Great Strength

Daniel Mapes, vice-president in charge of engineering - development, Walter Kidde & Co. Inc., New York: "Manufacture of large numbers of steel cylinders used as containers for compressed gases, and open-end shells for certain other purposes such as aerial rockets continues. Cylinders are made in lightweight forms by cold-drawing, and are supplied with rounded bases in a wide range of sizes. They are tested to withstand pressures as high as 3500 p.s.i., and wall thicknesses are held to very close tolerances.

"Developments in cylinder manufacture include induction heating of cylinder necks, which are then passed through a multiple-operation forming press. Manufacturing time has been reduced materially by providing a soap solution for cleaning and automatic processing between draws, in place of the former method of oil lubrication.

"Shatter-proofing of oxygen and carbon dioxide containers for aircraft is effected by winding with high-tension steel wire. New departures in the use of less-known gases have necessitated the development of especially corrosion-resistant shells.

"It is anticipated that increasing applications of compressed gases in industry, fire-control engineering and medicine will employ still larger numbers of cylinders, especially in lightweight forms."

Deep Drawing and Forming Problems Effectively Solved

R. E. Dillon, president, Lake Erie Engineering Corp., Buffalo: "We have viewed with interest the rapid advances which have been made in the art of drawing and forming of steel and other materials. Because of their difficult character, these operations have in many cases necessitated the use of hydraulic presses to successfully solve the forming problems. These same methods will be of considerable value in the manufacture of civilian goods after reconversion.

"Like its industry, this company is still occupied with the highest priority war work but we look forward to the time when its effort can be devoted to the manufacture of machinery for the efficient production of peactime commercial products."

Springs of Tomorrow Will Drop Pounds Yet Maintain Quality

F. E. Whittlesey, vice president and assistant treasurer, Raymond Mfg. Co., Division of Associated Spring Corp., Corry, Pa.: "During the last 4 years the spring manufacturer has been confronted with many problems which previously would never have been considered, due to the fact the tolerances were unusually narrow and both the maximum stresses and the range of stresses were so far above the recommended practice.

"An outstanding example of this condition is the gun spring, which design requires abnormally high stresses under very drastic operating conditions. Due to the critical conditions and the enormous demand for immediate delivery of the guns, the spring manufacturers and wire vendors co-operated to their fullest capacity in producing an item the stresses and tolerances of which have been far more exacting than anything produced in volume quantities in the past.

"New spring designs and materials will play an enormous part in the post-war design program, due to the ability of the spring manufacturer to produce an item weighing ounces, which formerly would require pounds of material."

Sealed Bearings To Operate Three Years Without New Oil

T. C. Fockler, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.: "The greatest advance in ball bearing design in many years is the development of the prelubricated sealed bearing. Because it is protected from dirt, this bearing assures clean original assembly. Furthermore, since it need not be relubricated for long periods of time and can be left in service until the apparatus is dismantled for periodic checks, the always present hazard of lubrication with dirty grease is eliminated.

"Heart of the sealed bearing is the lubricant. It is the recent advance in grease design that has made the sealed bearing possible. Lubricant used in the sealed bearings provided in certain motors is an especially compounded grease with a slow oxidation rate.

"Actual operating tests on motors indicate that bearings may be kept safely in service for 3-year periods without being relubricated. Many thousands of motors have been in successful operation for a much longer time interval without relubrication.

"Use of these bearings reduces the number of parts, thus assuring greater accuracy of alignment and longer bearing life. The motor is much easier to dismantle for inspections, and when provided with sealed bearings, has the advantage of cartridge-type construction without the disadvantage of cartridges and caps."

Designer Must Understand Function in Choosing Materials

Alfons Bach, Alfons Bach and Associates, consulting designers, New York: "The majority of products which we use daily are the outgrowth of inventive development. The first group is formed by items which are judged primarily by their usefulness. Design is rigid and controlled through engineering requirements. Appearance is only a contributing factor; the product itself is judged on performance. This group includes machinery, railroad, agricultural and automotive

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Whitcomb

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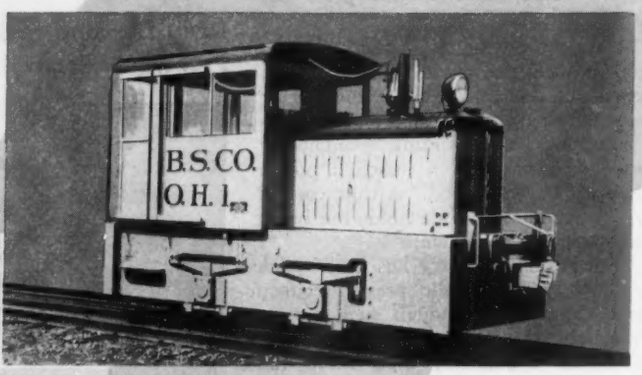

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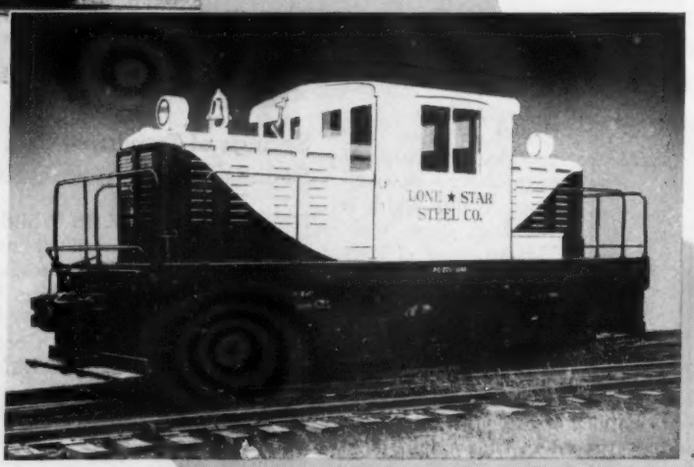

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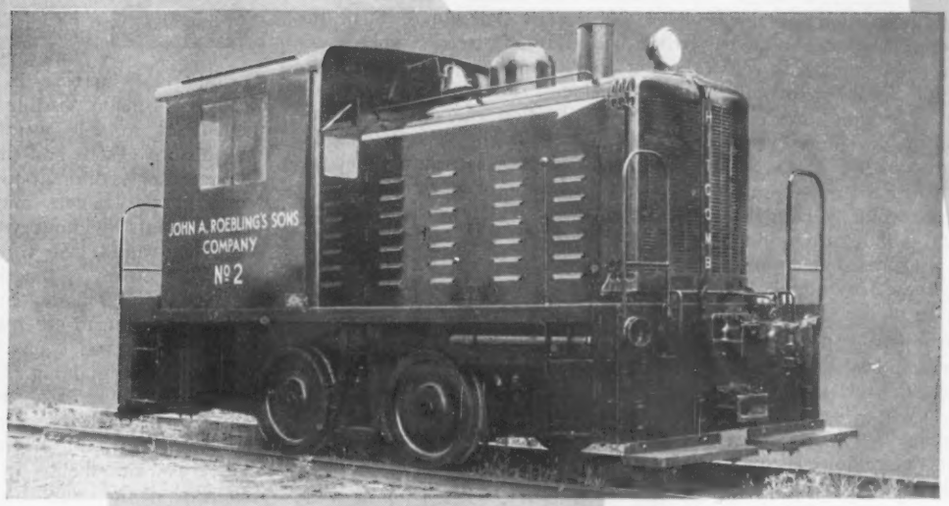

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JOINING and WELDING

New Electrodes Eliminate Preheating High-Tensile Stocks

J. H. Deppeler, chief engineer, Metal & Thermit Corp., New York: "In electric welding we have worked with the various important committees and developed, at their request, a new electrode of the stainless steel type, useful with both alternating current and direct current. There also have been developed electrodes for many newer higher tensile steels and those with air hardenable properties which will make welds without the use of preheating and without any underbead cracking. It is expected that these electrodes will increase in popularity after the war because of the larger uses for these quenched and drawn steels.

"There has been continued improvement in the quality of thermit welds both in the 'as-welded' and the 'post-heated' condition and developed for emergencies the use of thermit in making castings. Their use in welding stern frames and similar heavy parts for the Maritime Commission has grown enormously."

Resistance Welding Moves into Field of Heavy-Gage Metals

F. R. Hensel, director of research, P. R. Mallory & Co. Inc., Indianapolis: "In the field of resistance welding, considerable attention was given in 1944 to the welding of heavier gage materials and new techniques; welding machines and electrode materials are being developed for this purpose. Active work is also being continued on the resistance welding of hardenable carbon, low alloy and medium alloy steels.

"In the field of new contact materials, the development of silver-cadmium-oxide compositions has been an outstanding contribution.

"In the field of high strength, high conductivity copper alloys, advances have been made to produce alloys with high fatigue and low drift characteristics and the use of precipitation hardened copper base materials is increasing rapidly.

"The difficulties in machining high strength, high conductivity copper-chromium base alloys have been overcome by the development of a new copper-chromium-tellurium alloy which retains an electrical conductivity of 80 per cent IACS or better, combined with a tensile strength of approximately 75,000 pounds per square inch.

"In the field of powder metallurgy, a new bearing alloy was developed, consisting of an age-hardening copper base material. Ingredients are silicides and phosphides, and tensile strength values of 50,000 pounds per square inch, together with fatigue strength values exceeding 15,000 pounds per square inch, are obtainable. The alloys are lead-free but give antifriction characteristics similar to copper-lead alloys containing 20 to 30 per cent lead. Researches in the field of silver base bearing materials have resulted in the development of a silver-thallium alloy of superior antifriction characteristics."

Hydrofluosilicic Acid Clears 24ST Surface for Spotwelding

F. M. Morris, process and materials engineer, Fleetwings Division, Kaiser Cargo Inc., Bristol, Pa.: "A method recently has been developed by Rensselaer Polytechnic Institute in conjunction with the Welding Research Committee of the American Welding Society for the surface preparation of alclad 24ST aluminum alloy for spotwelding which consists of the use of hydrofluosilicic acid. The primary purpose of the acid is to remove the oxide which is inevitably present on the surface of clad aluminum alloy and reduce the contact resistance to a low uniform value suitable for spotwelding. It is understood that a number of aircraft companies are now using hydrofluosilicic acid quite successfully. Briefly, the procedure for the surface preparation of alclad 24ST parts consists of the following:

"Heavily soiled, greasy, and oily parts are degreased in a vapor degreaser. They then are immersed for 5 to 10 minutes in a hot solution of aluminum cleaner to remove light oil, dust and identification ink marking. Next, parts are rinsed in cold running water, following which operation the surfaces should be chemically clean, i.e., free from water-break. Immersion of thicknesses up to 0.031-inch for 6 minutes and thicknesses of 0.032-inch and up for 10 minutes in a 3 per cent by volume solution of 27 to 30 per cent by weight of commercial hydrofluosilicic acid follows. Thorough rinsing in cold running tap water for about 4 minutes and drying prior to spotwelding is the final step in the procedure.

"We have been using hydrofluosilicic acid for the surface preparation of alclad 24ST for spotwelding during the past year and have obtained very satisfactory results."

Sound Welding Permits Use of Steam at Extreme Pressures

R. B. Lincoln, director, National Weld Testing Bureau, Pittsburgh: "To a considerable extent, the recent developments in extremely high pressure steam (1400 pounds per square inch and higher) with its important increase in thermal efficiency, was made possible by the development of suitable welding procedure for pressure vessels and pipe. It would be exceedingly difficult to make riveted joints in the boilers and screwed or flanged joints (without welding) in the pipe that would give trouble-free service. This steam is practically red hot, that is, about 935 degrees Fahr. This temperature causes creep and relaxes all bolted or screwed connections resulting in constant maintaining.

"Further, there is a stress concentration at holes and at the roots of threads that invites trouble from fatigue and caustic embrittlement. In a typical case, the stress at the edge of a rivet hole was approximately three times the calculated average stress in the ligaments between the holes. At these pressures and temperatures such conditions invite trouble while the uniformly distributed stress at a properly made weld allows relatively trouble-free service."

Centralized Control System Needed for Production Welding

Otto C. Tabbert, assistant manager, Welding Equipment Division, Harnischfeger Corp., Milwaukee: "Now that electric arc welding has become a full-fledged production tool, the next step is to apply the most efficient methods of control. This problem has been a particularly knotty one for most companies. In operating their welding departments on any of the standard methods of compensation, plant management has been without the complete control that is necessary. The systems do not go far enough in the case of welding because of the complexity of the problems involved.

"Any practical system must provide a complete control of all phases of welded fabrication which, in general, means control of (1) costs, (2) procedure, (3) production, and (4) quality. Final at-

(*Please turn to Page* 384)

HEAT TREATING

Induction Heating Big Industry Requiring 300,000 Kilowatts

Robert N. Blakeslee, vice president, Ajax Electrothermic Corp., Trenton, N. J.: "The outlook for induction heating is relatively unchanged since last year. The majority of new installations still are being made for war work, but the size and number of installations are smaller than during the period when war production equipment was more urgently needed.

"There has been a gradual shifting of the trend of thought, as we see it, from the idea that cost is secondary to speed and quality of product, to a more reasonable appraisal of both cost and benefits. Industry has been aware, almost since before 1928, that a better product could be made faster by using induction heating, but it has been only comparatively recently, with installations made largely for war production, that it has found the overall cost to be less than by other heating methods. In many instances the overall cost has been very much less.

"We have been in an effective position to watch induction heating grow. We have seen induction heating installations throughout the world substantially double each four years since 1920 to over 300,000 kilowatts by the end of 1944."

High Pay-Load Alloy Boxes Aid in Pack Carburizing

Paul Goetcheus, manager, fabricated products division, Michigan Steel Casting Co., Detroit: "Heat treating equipment has been undergoing changes in the last few years which make it more dependable. The trend has been to use metals best suited for the conditions and then to design them to make use of their best properties. A simple box, used as a container for work to be pack carburized and the carburizing compound, is a basic example. A fabricated alloy box 12 inches in diameter by 12 inches deep, complete with cover, legs and lifting lugs, can now be readily obtained. Weight is 32 pounds. Its normal life expectancy is 4000-8000 hours of furnace life at 1700 degrees Fahr.

"A plain sheet steel fabricated box of equal weight might be serviceable for 100-200 hours, while a cast steel box weighing 85 pounds could be counted on for 200-500 hours of life. Alloy cast boxes are useful for several thousand hours but their pay load is extremely low compared with the alloy fabricated box. If 50 pounds of work were to be handled, the ratio of pay load to box weight would be twice as great in the alloy fabricated box as in the alloy cast box. This saving is shown in the B.t.u.'s required to heat the cold mass entering the furnace to its working range of 1700 degrees Fahr., and by the saving in labor of handling lighter loads.

"This same application of proper design and use of metals is being applied to equipment other than pack carburizing boxes, in the heat treating field and the heat treating industry is progressing with better tools at its command."

High-Frequency Induction Heating Holds "Great Promise"

C. L. Ipsen, manager, Industrial Heating Division, Schenectady, N. Y.: "A significant wartime trend that offers great promise for postwar production is the increasing use of high-frequency induction heating for forging, hardening, brazing, and soldering. Heat is generated in only that portion of the work that requires processing. There is practically no waste heat. The time of heating is of exceedingly short duration.

"Capacity of induction-forging furnaces now in use heating shells for forging and nosing and for nosing bombs totals more than 50,000 kilowatts. Improved working conditions, speed of heating, reduced floor space required for the furnaces, and absence of scale are advantages that have brought the overall cost of induction forging well within that of former forging methods.

"Selective hardening of such parts as gear teeth, crankshaft bearings, and piston pins, as well as localized heating for brazing and soldering, are accomplished with induction heating in a matter of seconds. The induction heater is 'at home' right in the production line beside other machine tools. With such installation, the process eliminates time-consuming and expensive handling inherent in former hardening methods.

"In many cases these processes can be mechanized for full automatic operation with controls that insure a uniformly high-quality product. This is another factor which makes the induction heating method ideally suited to production-line use.

"Extensive use has been made of electric-furnace brazing in the mass production of such wartime products as tank-track bodies, bombs, and machine parts. By demonstrating its effectiveness and low cost in bonding these highly-stressed parts, the electric-furnace brazing process has paved the way for much more extensive use in the manufacture of peacetime products."

Buying Steel "On Performance" Stops Low-Hardenability Heats

T. A. Frischman, chief metallurgist, Axle Division, Eaton Mfg. Co., Cleveland: "Further studies of hardenability of steels during the past year have revealed the inadequacy for some applications of purchasing steel on a chemical analysis basis alone because of the wide range in hardenability when all the elements are either on the high side or low, employing the full chemical analysis range of SAE, AISI, or NE grades. Therefore, with the steel mills now making it possible to purchase steel guaranteed to fall within published hardenability bands, means are at hand to prevent low hardenability heats where they are unwanted.

"Additional information also has been published on isothermal annealing as a result of further studies by various investigators. Many advantages have accrued thereby, especially in saving furnace time, with a simultaneous improvement in machinability. The isothermal diagrams have also been helpful to the steel treater by giving a clearer insight into the hardening characteristics of the steel and particularly in regard to the renewed interest in the various types of delayed quenches.

"Further progress during the past year in the induction hardening field has resulted in the addition of many more parts to the already imposing list heat treated throughout industry in this manner. This ever increasing interest was clearly revealed by the attention given the induction hardening displays at the recent Metal Congress."

Wartime Progress in Furnace Building Tops All Other Periods

Harry Dobrin, vice president, Furnace Engineers Inc., 1551 West Liberty avenue, Pittsburgh: "The furnace manufacturing industry has had a very important part in the war effort. But for its skill and ingenuity the 'miracle of production' would have been well nigh impossible. Whether it be guns, bombs, shells or plane parts, tanks or ships, modern furnaces are the vital tools needed to produce them, because the quantity and

quality of the product could not have been realized by the use of obsolete and ancient methods.

"This fact has been recognized by the Government in that it has classified this industry as part of the machine tool industry—furnace division.

"Steel manufacturers, as well as processors, have come to recognize the furnace as an important production tool. It now is generally acknowledged that the steel manufacturer or processor is willing to pay more for scientifically designed burners, instrumentation and accessories alone than previously was considered sufficient for the cost of an entire furnace by itself.

"More progress has been made in the furnace manufacturing art in the last 3 or 4 years than was recorded in the entire period between the First World War and 1940. America today enjoys world leadership in mechanical and combustion skill as applied to the metallurgical heating furnace."

Localized Induction Tempering Feats Watched with Interest

Robert C. Gibbons, assistant chief metallurgical engineer, Eclipse-Pioneer Division, Bendix Aviation Corp., Teterboro, N. J.: "This last year has shown rapid advances in the use of induction methods for heating and heat treating. Additional manufacturers of equipment have entered the field and new designs have been prominently mentioned recently as well as new uses.

"Among the most interesting has been increased use of induction equipment for brazing purposes, generally using silver solders as brazing medium. Brazing of carbide tips on tools has been an excellent example. Producers of brazed assemblies, especially of hydraulic equipment type, have found induction heating methods to be rapid, simple and inexpensive.

"Increases in automatic setups is the order of the day, with hopper feed and automatic quench designs being tried out for many small parts. With some designs, such as gears, equipment for slowly rotating the parts for more uniform heating has been designed. Most of such setups are tool room made for the particular job rather than established designs sold by dealers.

"Increased attention is being paid to hardening to various depths. The high frequency machines that give very shallow depths have found some specialized uses. On the other hand, lower frequency machines, using less power but longer time cycles, are doing 'deep-hardening' at a usual rate of about ½-inch of depth per minute. Parts are being hardened all the way through in thicknesses heretofore impractical.

"Induction hardening, after preliminary furnace hardening and tempering, has solved many tricky jobs. Alloy steel gears, for example, are sometimes hardened all over to 34-38 rockwell C, finish machined, then teeth are induction hardened to a higher hardness. Less distortion often makes this preferable to carburizing.

"Localized induction tempering, although tricky and far from being foolproof, sometimes has been used to lower hardness of one area of a part, especially threaded ends. The job is difficult because of measurement and control of temperature, but such jobs are possible when special control methods are employed.

"Use of induction equipment for rapid heating of small bars and billets for forging has been reported. Best possibilities appear to be small bars heated in one area only for localized forging—such as upsetting bolt heads."

Isothermal Diagrams Save Lost Motion in Treating Parts

Joseph G. Gagnon, chief metallurgist, Hudson Motor Car Co., Detroit: "Development of some of the NE steels has given the metallurgist a greater selection of materials for postwar work. Another achievement has been the clarification and the publication of isothermal transformation diagrams, thereby enabling the heat treater to choose a heat treatment which can reduce to a minimum the movement of intricate parts during the process of hardening and tempering.

"Hardenability has also come in for considerable study and, with the publication of various bands, should enable the engineer to have a selection of several types of steels for a given part."

Radiant Gas Heat Practical for Tin, Strip Lines and Melting

Frederic O. Hess, president, Selas Corp. of America, Philadelphia: "Further developments and applications of high speed heating techniques with air and gas during 1944 have established at least one significant result, namely: Continuous heat treatment (annealing or hardening) of bar stock and tubing. Sufficiently high treating rates have been applied to make the continuous single line heat-treating process practical and economical with apparent beneficial effects upon uniformity and surface condition of the stock. It seems safe to expect and predict expanding application of this heat-treating method in the future in the ferrous as well as nonferrous industry.

"Controlled radiant gas heating furthermore has proven practical and economical in first cost and operating cost for tin fusion lines. Only 6 feet of heating panel produce tin plate at a production speed of 600 feet per minute. Such high rates of heating indicate definite possibilities in continuous strip heating.

"Radiant gas heating also has been extended into the melting field. Aluminum and magnesium furnaces are operated with pattern radiant firing at fuel consumption as low as 1300 B.t.u.'s per pound of magnesium melted, with pot life of 2000 hours and more."

Hardenability Test a Means of Improving Carburizing Practice

T. L. Counihan, chief metallurgist, Hyatt Bearings Division, General Motors Corp., Harrison, N. J.: "Hardenability testing is becoming an important tool for use in steel selections. It is felt that it also can be used as a means of improving carburizing practices.

"While it was demonstrated years ago that when carbon concentration is at the eutectoid composition the greatest hardness can be developed in the steel, it is only of comparatively recent date that the great influence of carbon concentrations above eutectoid compositions has been realized. As a single illustration it may be mentioned that the AISI 400 series steels have their maximum hardness at about 0.63 per cent carbon. Should a carburizing grade of the above series, such as 4320, be carburized so that the carbon concentration at the surface is raised to 1.12 per cent carbon, its hardenability over quite a range of cooling rates is reduced, so that it corresponds to the hardenability of a 4300 series steel containing 0.35 per cent carbon. This means that the hardness drops rapidly as the carbon concentration goes above the eutectoid composition. The drop in hardness necessitates the use of an additional alloy to compensate for the hardness loss.

"This fact may be brought to light by a study of hardenability data. It is desirable, if maximum hardness is to be obtained with a minimum amount of alloy, that the carbon concentration be kept as near the eutectoid composition as possible. This can best be done by allowing the carbon at the surface to diffuse inwardly during the carburizing cycle, which is readily accomplished, when gas is used as a carburizing medium, by not feeding the gas into the carburizing chamber during a part of the cycle.

"It is believed that the possibilities

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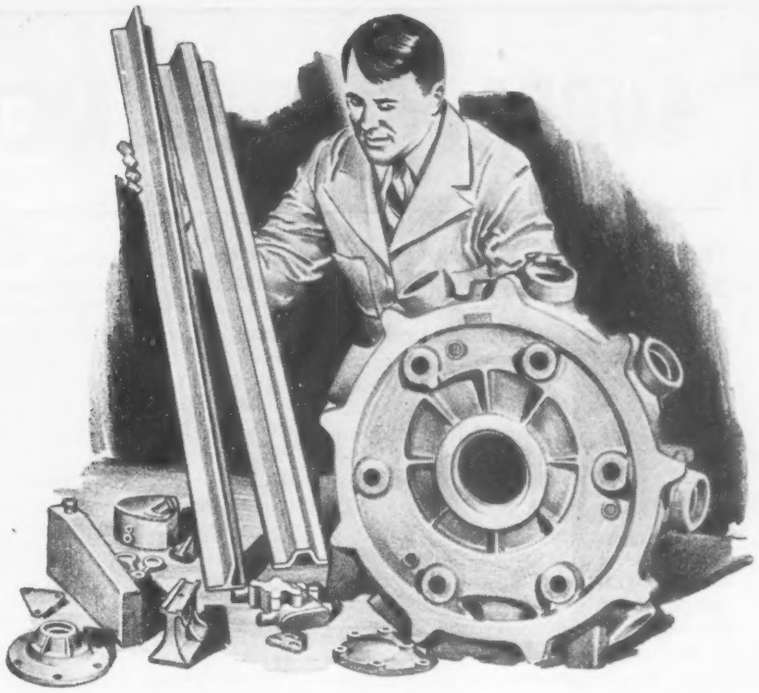
Magnesium alloys are fabricated and joined by all common methods



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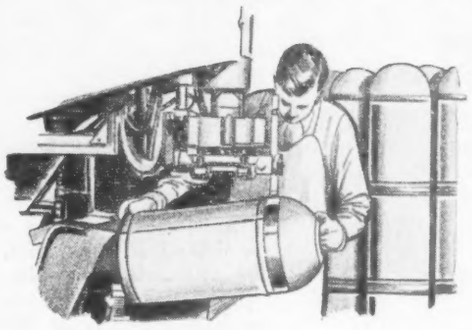

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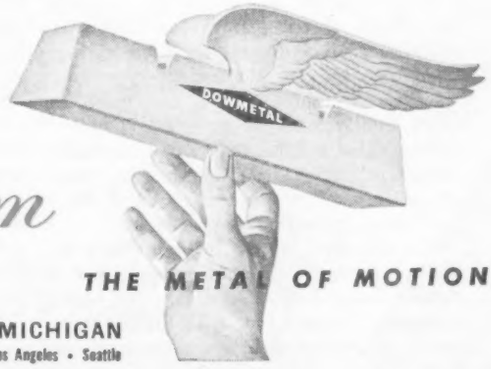

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SURFACE TREATMENT

Foresees Shift in Demand Toward Decorative Plating

C. W. Yerger, executive vice president, Hanson - Van Winkle-Munning Co., Matawan, N. J.: "During the war period there has been great development in the plating industry along general lines. Very fortunately, in this industry the same developments can be carried into peacetime and the conversion problem is not as bad as it would be in an industry where the peacetime requirements were entirely different from wartime requirements. In wartime the stress is on the utility of the plated work, and in peacetime the stress is on the decorative feature of plating, but in either case it requires much the same equipment and supplies to carry through.

"There have been very strong developments in plating of all metals such as nickel, zinc, tin and copper, but the outstanding feature in electroplating probably is toward alloy plates. Very astonishing results have been obtained along these lines and it looks very much as if this development would produce finishes which are more protective, of denser structure and considerably harder than would be assumed from the constituent metals."

Electrodeposition of Gold, Nickel, Chromium Progresses

Colin G. Fink, head, Division of Electrochemistry, Columbia University: "In the electrochemical field, one of the most interesting and fascinating developments has been the high-frequency induction heating of metal surfaces. Not only has it been possible to control to a nicety the depth of case, but also (and this promises to be very far reaching) it has been possible to electrodeposit metals such as chromium, nickel, and gold on other metals such as steel and copper, and produce a finish which can be made highly attractive from an artistic point of view, or of pronounced physical characteristics, including photoelectric.

"In the past it has been difficult to control the atmosphere surrounding the article being heat treated in the high-frequency furnace but, with the development of controlled furnace atmospheres with the aid of lithium, this important problem has been solved nicely.

"Another point that might be mentioned is that, in place of uniform deposits of one metal or another, the deposition can be so controlled through shielding that two or more metals can be electrodeposited on a base such as steel or copper and, after heat treating, these two or three metal deposits will tend to run into each other and bring about highly artistic effects.

"Aside from the rapidly growing development of plating before fabricating, for which the strip steel industry is primarily responsible, considerable activity has been recorded in the field of depositing metals on plastics.

"Metal-coated plastic articles have, among other things, the advantage of high resistance to abrasion without appreciable increase in the weight of the article."

Prospects for Tin Revive Interest in White Bronze

Bruce W. Gonser, supervising metallurgist, Battelle Memorial Institute, Columbus, O.: "Lead coating of steel has definitely taken its place alongside galvanizing and tinning as a primary means of protecting steel with a metallic coating. Sheet, strip, and miscellaneous dipped products now are available. Very thinly-coated sheet, some made with regular tinplate and terne-plate equipment, forms an excellent base for a painted surface. Moderately heavy coatings of the same composition—2 or 3 per cent each of antimony and tin, the rest lead—have shown excellent resistance to weathering. By increasing the antimony content (as from 8 to 12 per cent), greater hardness and improved weathering under humid conditions is secured.

"Interest in white bronze plating steel parts has increased with the possibility that tin may become available before long. These electrocoatings of a copper-tin alloy, usually containing from 35 to 45 per cent tin, have an attractive and silvery appearance, and the excellent throwing power of the electrolyte permits good plating where chromium and some of the other coating metals are ineffective. The relatively high melting point of the bronze coatings has made it possible to use them advantageously as a stop-off in nitriding.

"Chromizing and siliconizing of iron and steel products is being used or is in prospective use for a number of specialties, but commercial development is slow. With recent release of aluminum for many peacetime applications and prospects for more being made available, it is probable that commercial development of aluminum-coated steel sheet and strip will develop rapidly."

Bright Alloys Make Fine Coating for Instruments

G. H. Woodard, New Products Division, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.: "One of the outstanding metallographic advances made during the past year is a bright alloy plating process which is providing a hard, nonmagnetic coating for numerous fine instruments.

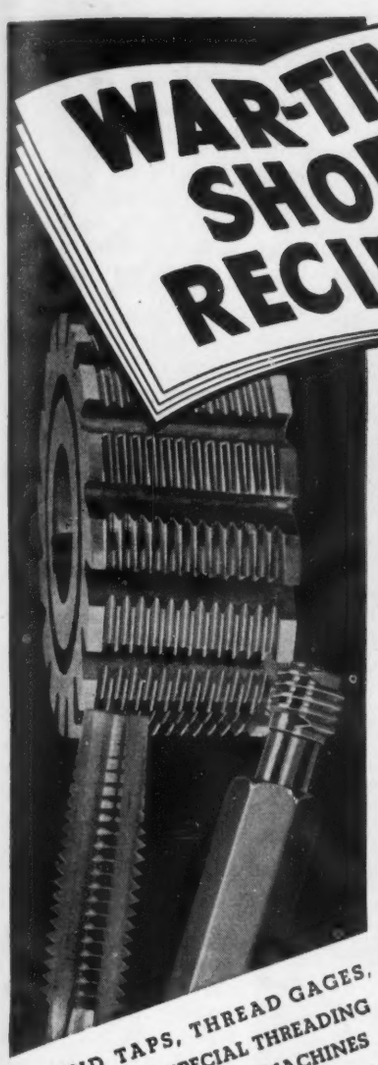
"The deposit or plate is composed of copper, tin and zinc, and has a combination of properties not inherent in the individual metals. Outstanding characteristics of the deposit are good electrical conductivity, hardness and excellent corrosion resistance. Seldom deposited to more than 0.0002-inch thickness, the alloy will easily stand a 200-hour salt spray when plated to that dimension. When a rosin flux is used, the alloy can be soldered more easily than tin. This is due to the fact bright alloy plate does not tarnish and, consequently, there is no oxide to affect subsequent soldering operations.

"Anodes of the same composition as the deposit are used in the electrolytic bath to maintain automatically the metal concentration of the solution. While the bath is somewhat more difficult to control than the single metal type, the cost of the plate is somewhat less than that obtained with a single metal process for some applications.

"In conclusion, the bright alloy plating process should find many postwar applications not only because of the advantages mentioned, but also because its reflectivity approaches that of silver, hence making it applicable for decorative trim on hosts of items such as office machines, gages, and general hardware."

Phosphate Baths Produce Bright, Adherent Finishes

C. B. F. Young, electrometallurgist, Flushing, Long Island, N. Y.: "In the field of metal finishing, a lot of progress has been made during the past year. Most of this, of course, is due to the tremendous volume of war work which had to be finished under specifications in limited time and with not enough help. It should be pointed out that, in many in-



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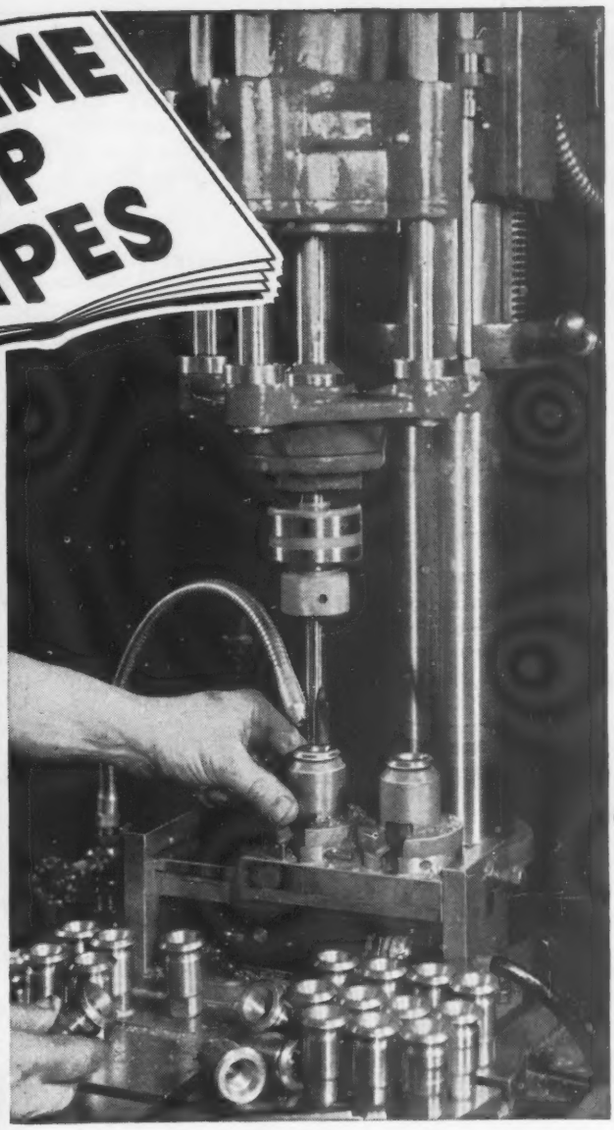

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stances, the help obtainable has been of poor grade.

"Progress has been made in the field of cleaning metals. More and more cleaning solutions are being used which are a combination of saponifiable type with the solvent type. In these cases, surface tension of the two solutions is lowered by interfacial agents being present. At the same time, a third agent is present which is one that will produce a clear solution. Thus a clear solution is produced which has solvent powers of hydrocarbons and saponifying properties of alkaline solutions. This type of solution does a better job of cleaning in quicker time.

"In the field of metal plating great strides have been made in adapting complex phosphates to electroplating baths. It is the prediction of the writer that the phosphate plating solution is going to be adapted to plating many metals and alloys. Already zinc, copper, nickel, platinum and cadmium have been investigated and most of these are being used industrially at the present time. Alloy plating can use these interesting baths also. Phosphate baths produce bright, small grained, good adhering deposits from solutions which are good conductors of electricity, are inexpensive, do not decompose on exposure to air, or when used. The cathode and anode efficiencies are high and the baths respond to high temperature treatments. It is my opinion that the adaptation of phosphate baths to plating solution is the outstanding development of the past year."

Explore New Pigment of Chromated Red Lead

George Diehlman, research laboratories, National Lead Co., Brooklyn, N. Y.: "Unusual problems created by the war have taxed the ingenuity of the paint industry, but the challenge has been met successfully and many new developments are the result. New and improved pigments, drying oils, synthetic resins and other products have materialized. Some of these already are in use, though in some instances they have been restricted to paints directly related to the war effort. Others are being more thoroughly explored before releasing them to the trade.

"Red lead is still the most widely used corrosion preventive pigment. A new pigment known as chromated red lead, which combines the advantages of red lead and chromates, is being explored. Another effective pigment in a similar stage of development is a chromated compound of barium known as pigment E. Both these new pigments are expected to be released to the trade for postwar use.

"Metal protective paints in which many outstanding developments have been incorporated will be available for general use in the postwar era. They will provide effective and economical protection, on steel structures of all kinds, against the costly consequences of corrosion."

Petroleum Derivatives of Many Types Are Promised

R. R. Thurston, Technical and Research Division, The Texas Co., New York: "Materials for protecting metal surfaces against rust and procedures for proper packaging have received vigorous attention by our armed forces and manufacturers of rustproofing materials, particularly those materials made from petroleum. This has led to the development of a number of inhibitors which provide exceptional rust prevention properties.

"Many exterior surfaces of equipment can be protected by proper painting, but most equipment has many exposed surfaces required to be free from any coating when in use. For such surfaces, petroleum base materials that can be removed when necessary by wiping with a solvent have proved ideal. They are now available in many consistencies for all types of application and give protection for long periods against high humidity, sunshine, salt spray, and oxidation. They have the advantage of low cost, improved protection against rust and ready removability compared to ordinary paint.

"These products will find a wide postwar application for articles of many kinds not only as a protective coating at the time of manufacture of machines, structural steel, tools and spare parts, but as cheap effective material that can be applied by hand at home to tools, farm equipment, etc. Industry will benefit from lower cost protection of steel structures, tanks, bridges, and equipment by using these products which have proved their value for wartime purposes."

Cite Hot Phosphate Coating as Primary Inhibitor of Corrosion

George H. Pimbley, superintendent, International Rustproof Corp., Cleveland: "The most significant event of the year in rustproofing has been the discovery by the armed forces that previously accepted protective coating systems are not good enough for equipment and munitions under present day battlefield conditions. The salt atmosphere of oceans, the warm moisture of tropical jungles, the lack of docks and warehouses—all promote such vicious corrosion that ordinarily good protective coatings are broken down beyond the danger point. Lives and victory depend upon perfect supplies and equipment, hence it was imperative to step up sharply the quality of metal preparation and painting methods. Specifications have been overhauled; more thorough cleaning of metal surfaces is insisted upon; hot phosphate coating to provide paint adhesion and insulation against corrosion is required for most steel and zinc surfaces; the very highest grade anticorrosive primers and finishing paints are prescribed. Testing is more stringent; for example, salt spray test requirements in some cases have been increased by as much as 100 hours.

"If such measures are necessary to meet a severe corrosion problem in warfare, then the same approach is indicated for similar postwar problems. We will export metal products to regions with the same tough climatic conditions. We will wish to cope with severe conditions of usage at home better than we have done in the past. The armed forces have shown the way—clean thoroughly, apply a good phosphate coating, follow up with really good baked primer and finishing paint."

Rust Preventive Must Be Used To Protect Stored Machines

Maurice Reswick, Engineering Division, Standard Oil Co. of New Jersey, New York: "Among the far reaching wartime developments which surely will be carried over to peacetime production is the emphasis placed on proper surface protection to prevent corrosion. Highly machined expensive replacement parts as well as finished armament is now being shipped to all parts of the globe and resistance to the corrosive action of the elements under the most adverse conditions is being combatted by proper packaging and by coating the metallic surfaces with specially compounded petroleum products.

"Basic requirements of removable petroleum base coatings are uniform spreading, adhesion to metallic surfaces, and self-healing on rupture of film. The function of some specific types of rust preventives is that of absorption and neutralization of any corrosive elements which may be present on the surface of the metal after final machining, such as finger prints from handling the parts with bare hands.

Surface treatment for temporary protection will receive more attention in the metalworking industry after the war, particularly between the various processing operations within the plant. For example, a time element of from 2 days to 3 months may elapse in a wire mill

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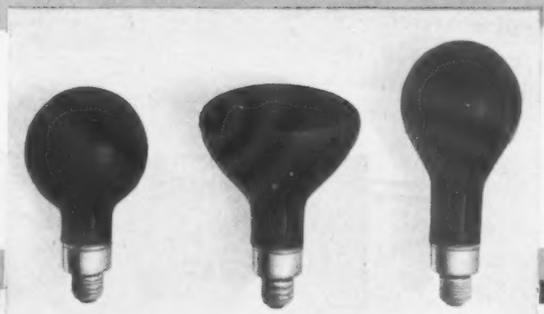

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DEVELOPED AND MANUFACTURED BY
VERD-A-RAY
CORPORATION :: TOLEDO OHIO

TRAMRAIL SYSTEM SAVES '5,

IN ONE OF WORLD'S LARGEST SMALL ARM MA

Because of the efficiency of a Cleveland Tramrail overhead system in the bullet core machine department of the St. Louis Ordnance Plant, St. Louis, Mo., it has made possible the installation of 380 National Acme Gridley Automatics in an area which by conventional planning would be sufficient for only half that number of machines. This made necessary a building of only 75,000 square feet instead of 150,000 sq. ft.,—and consequently a saving of 75,000 sq. ft.

The Gridleys, which produce the cores for 30 and 50 calibre armor-piercing bullets, are closely arranged in rows with just enough room between for the operators to work comfortably. No space is allowed between machines for the movement of materials on the floor. The rod for the cores is carried to the racks provided for each machine by the Cleveland Tramrail system. The overhead rails over the long rows of machines are so located that the carrier travels directly above the racks, making it a simple matter for the Tramrail operator to lower bundles of rod into the racks quickly and without assistance from persons on the floor. The carrier is run onto any of the several tracks over the machines by means of a transfer bridge at the end of the building.

The carrier travels on two rails and the grab has a three-point rope suspension, permitting it to be raised or lowered with ample rigidity. The two pairs of arms of the grab are opened and closed by a motor-driven crank. The operator may deposit one or several bundles of rod in a rack by manipulation of controllers in his cab.

A large number of Clevelend Tramrail cranes, carriers and trackage are also used in many other departments of this vast modern arsenal, both in the bullet core plants of McQuay-Norris Manufacturing Co. and the case fabrication plants of the United States Cartridge Co.

Since the day after Pearl Harb
when the first bullet was co
pleted at the St. Louis Ordna
Plant, more than 3,000,000,
(3 billion) rounds of 30 and
calibre ammunition have b
produced.

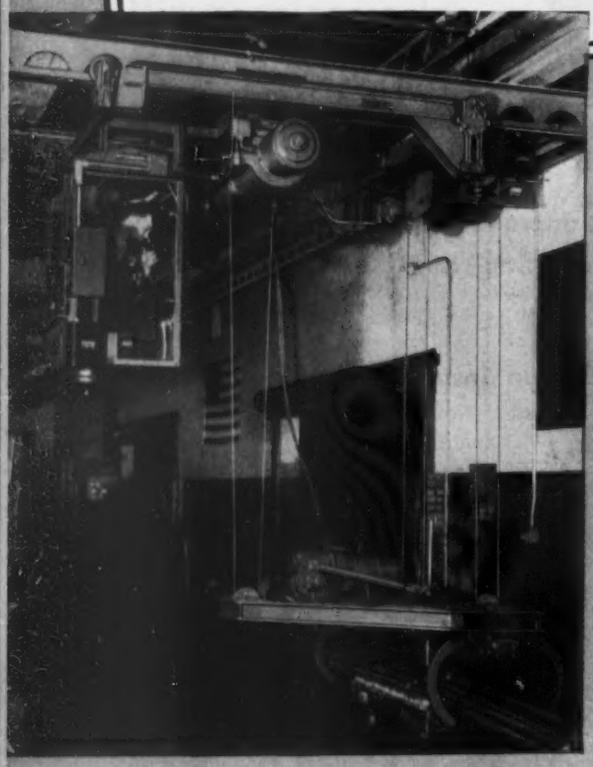


Photo T-4046
The rod comes from the adjacent room where the rod is unloaded from railroad cars and placed in storage by a Cleveland Tramrail cab-operated transfer bridge system. The illustration shows how it is picked up.

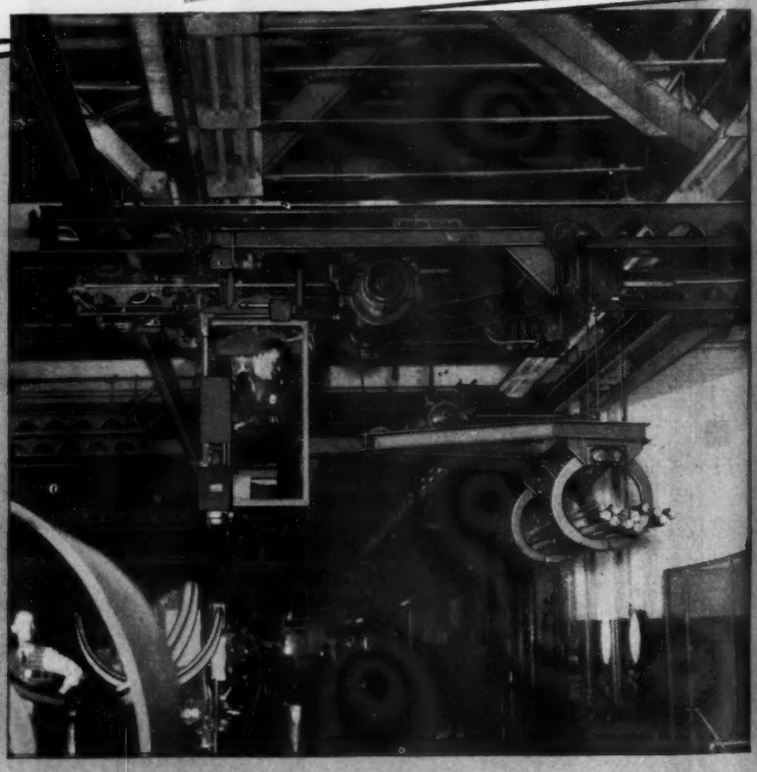
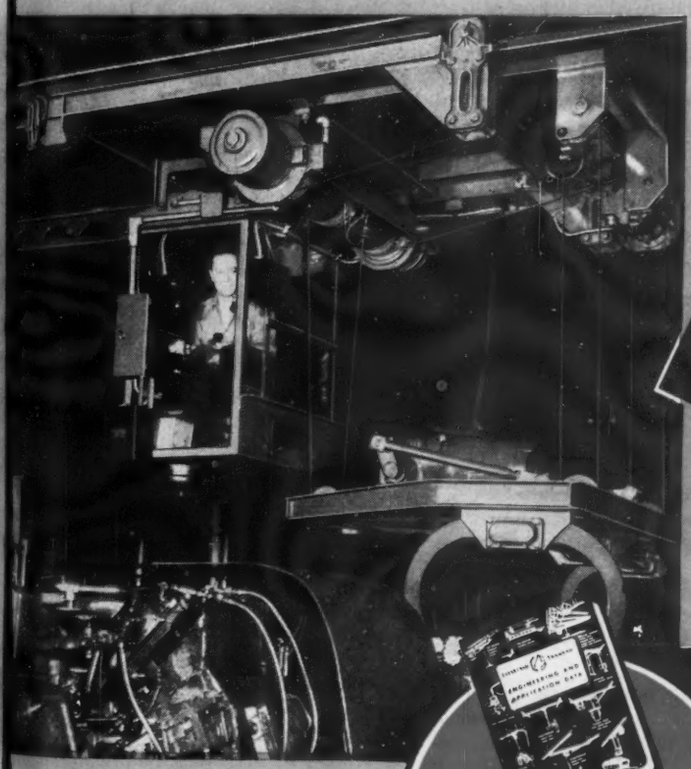
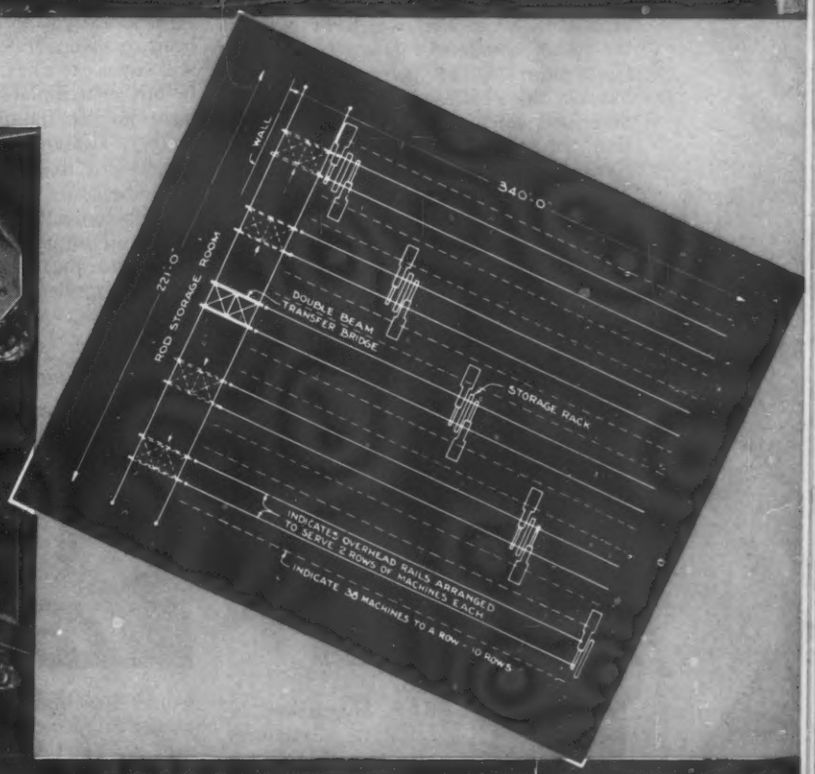


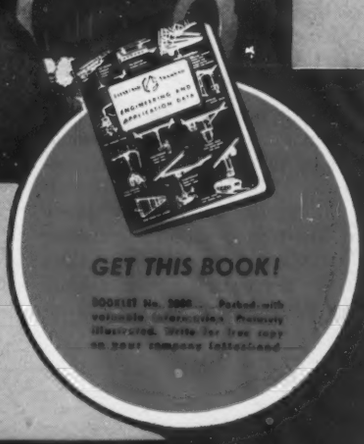
Photo T-4047
Here the carrier is on the transfer bridge which the cab operator can cause to be interlocked with any of the five pairs of track over the core-turning machines.

S 5,000 SQ. FT.
M MMUNITION PLANTS

to T-4045
hours a day,
let core rod is
vered to the
dreds of hun-
metal-eating
hines in this
room with this
Cleveland
rail carrier.




WALL
340'-0"
221'-0"
ROD STORAGE ROOM
DOUBLE BEAM TRANSFER BRIDGE
STORAGE RACK
INDICATES OVERHEAD RAILS ARRANGED TO SERVE 2 ROWS OF MACHINES EACH
INDICATE 36 MACHINES TO A ROW - 10 ROWS



GET THIS BOOK!

BOOKLET No. 3008 ... Packed with valuable information. Profusely illustrated. Write for free copy on your company letterhead.

to T-4043
ough the machines are arranged
tly together the cab operator has no
ficulty in delivering bundles of rod
he racks. He can deliver all or any
mber of bundles of rod in a load by
ying the opening of the motor-oper-
d arms of the rod grab.

CLEVELAND TRAMRAIL DIVISION

THE CLEVELAND CRANE & ENGINEERING CO.

1125 EAST 283rd ST. WICKLIFFE, OHIO.

LUBRICATION

Improvements in Hydraulic Oils To Reduce Shut-Downs

J. C. Van Gundy, Technical and Research Division, The Texas Co., New York: "Demand for increased production by machine tools necessitated by the war has brought out defects or weak spots which would not normally have been found under ordinary operating conditions.

"Hydraulic systems in machine tools designed for normal operation in many cases became inadequate when machines were worked above rated capacity. High operating temperatures caused straight mineral hydraulic oils to oxidize and sludge. In extreme cases machines had to be shut down weekly for cleaning of the hydraulic systems and charging of fresh oil.

"Deterioration of hydraulic oils is caused by oxidation, which in turn is the result in part of increased operating temperatures. The petroleum industry has met this challenge by adding certain materials which inhibit or retard oxidation, tripling the life of hydraulic oils.

"A second improvement in hydraulic oils has been the addition of rust inhibitors. Although hydraulic systems are closed, condensation of moisture from air entering the system through leaks or vents often results in the formation of rust particles, which may cause serious damage to the hydraulic pump.

"These two major improvements in hydraulic oils; namely, the addition of oxidation and rust inhibitors already are resulting in much more efficient operation of hydraulically controlled machine tools, and in the postwar era can be expected to lower production cost by decreasing the 'shut downs' for maintenance of production machines."

Steelmakers Await Release of New Lubricating Products

R. S. Shoemaker, lubrication engineer, Middletown Division, American Rolling Mill Co., Middletown, O.: "A survey of industrial lubrication indicates that few, if any, of the newer wartime lubricating products have as yet become available for use in the steel industry. By new products is meant the ever growing list of oils and greases which according to authentic rumor have been developed by major oil companies for lubricating combat machinery of our armed forces.

"Those charged with the responsibility of providing the best possible lubrication for steelmaking machinery eagerly await the release of such materials which we have been led to believe will have vastly superior qualities over materials now available. If these rumors prove to be true, we should some day have fluid lubricants with greatly increased resistance to oxidation, foaming, corrosion and with neutralization numbers approaching zero values and carbon residues of only a trace; and also demulsifier additives of higher efficiency and safer to use, for water removal from circulating systems of steam turbines, and oil lubricated backup bearings of hot and cold strip mills, etc. Viscosity index, pour point, and catalytic reaction will be almost completely under control. Fluid and plastic rustproofing materials will be greatly improved and will have had a thorough tryout in all climates.

"Greases will be available which have been so compounded that a single type will cover extremes of temperature never before contemplated. They will also have greatly improved water repellant quality, and many more desirable features.

"Lubrication engineers of the steel industry, generally express the hope that major oil suppliers may be able to extend into the reconversion period the splendid service they have given during these trying war years."

New Greases May Be Ideal For Motor Lubrication

J. F. Pelly, lubrication engineer, Bethlehem Steel Co., Bethlehem, Pa.: "During the last few years research on special lubricants has been concentrated for war purposes. Greases were needed that would flow under moderate pressures at minus 50 degrees Fahr. and yet maintain sufficient body to stay in place at 200 or 300 degrees Fahr.

"In the steel industry the requirements are not so severe. Seasonal changes can be taken care of by changing the grease. The new greases developed for the armed forces may prove helpful for low-torque motors operating fans for circulating gas in annealing furnaces. It is possible that lithium greases may prove helpful in such locations but little has been done so far to establish this product. Barium grease looks good at high temperatures and a place may be found for it where temperatures remain high.

"Steel plant lubricating oils have not changed materially in the last few years. Solvent-processed oils fortified with additives had been slowly replacing the old acid-treated oils even before the war. If these oils are better we are unable to detect it, but, at least, they are satisfactory. New turbine oils, outstanding in performance, contain numerous additives for retarding rusting and oxidation and for holding up viscosity, etc. They are a real improvement, especially in severe turbine work such as top turbines or turboblowers.

"The greatest improvement arising from war conditions has been in the acceleration given to the installation of centralized grease systems. Some steel plants have as many as 3000 or more systems, hand-operated and automatic. With the shortage of labor it is well established that centralized lubrication systems have aided greatly in keeping steel plant equipment functioning, thereby maintaining the tremendous tonnages that have been produced by the steel plants during the last few years."

Additives Are Valuable Assets In Industrial Lubrication

C. E. Pritchard, chief lubrication engineer, Republic Steel Corp., Cleveland: "Additives in lubricants have played a seemingly greater part in 1944 than in previous years in aiding the petroleum research technologist to keep pace with the progressive developments of the machine designer. Unquestionably the various types of additives offered today will be utilized in many other fields of application beyond their present scope of activity and will prove to be a valuable contribution to the postwar period.

"Considerable interest has been manifested in regard to the proper procedure for handling lubricants to prevent contamination. Cleanliness of the lubricant is absolutely essential to the efficient flow of production and can be maintained by the adaptation of the correct handling procedure. Transfer of the lubricant in most cases can and should be made from the original container to the bearing without the possibility of contamination by provision of the proper type transfer pump and container. On the other hand the provision of a color or numerical code system coupled with complete lubrication instructions for the various units have assisted materially in assuring that the correct lubricant in the recommended proportions and at the prescribed frequency has been applied.

"General acceptance of the manual or automatic centralized lubricating sys-

(*Please turn to Page* 400)

MATERIALS HANDLING

"Pickup-to-Destination" Handling Finds Favor

A. F. Anjeskey, sales manager, Cleveland Tramrail Division, Cleveland Crane & Engineering Co., Wickliffe, O.: "Materials handling methods are changing, the tendency of management being to install equipment capable of picking up a load at one point and delivering it to its destination at the other point automatically. New applications of this kind are being made at an increasing pace.

"Another development known as the stabilized hoisting unit, originally applied for handling racks in anodizing operations and successfully applied in plane assembly, has recently been applied to handling automatic welding heads on continuous welding operations, producing a smooth, straight-line weld. Two welding heads have been applied on the stabilized platform, permitting the adjustment of the heads for welding operations at two points. The application of the stabilizing unit in the aircraft industry suggests its use for assembling large bulky objects, permitting the suspension of the assembly at the most convenient working height and at all times maintaining a clear working floor."

Diesel-Electric Ore Transfer Cars Aid Steel Production

E. W. Schellentrager, vice president, Atlas Car & Mfg. Co., Cleveland: "The outstanding development in steel mill transportation during the year 1944 was the placing in service of two self-propelled diesel-electric side dump ore transfer cars at one of the large steel plants in the Pittsburgh district. The success which has attended the installation of these two units indicates that there will soon be a demand for diesel-electric powered transfer cars for use in connection with car dumpers and stockyard reclaiming activities at blast furnace plants.

"This self-propelled equipment eliminates the necessity for standby power to satisfy transfer car demands, eliminates the necessity of installing and maintaining electric conductor systems, and provides flexibility of operation not obtainable with the usual electrically operated equipment. It appears that operating costs will compare very favorably with straight electric-driven equipment.

"A number of detailed improvements have been made in connection with scale dials and recording equipment so widely used in blast furnace stockhouses. These relate to arrangements which prevent incorrect operation even in the hands of the most inexperienced personnel. Automatic dials for coke weighing have been redesigned to be completely non-jamming, so that it is impossible to damage the mechanism due to incorrect setting or operation.

"There has been an increase in the interest in electric heating of hoppers of blast furnace transfer cars so that practically all cars recently built are equipped with electric hopper heaters to prevent freezing of the load during severe winter weather. Improvements have been made in methods of installing, insulating and connecting these heater systems so that they stand up very well. These heaters are dependable and do their job with very little maintenance and at very low cost."

Palletizing May Be Generally Adopted for Postwar Shipping

Adolf Larsen, vice president, in charge of sales, Gerrard Steel Strapping Co., Chicago: "Until finished products are packed and properly stowed in freight cars, motor trucks, or other agencies of transportation, materials handling operation cannot be considered as complete. In a broader sense, completion of the task is achieved only after the commodity arrives at destination in a usable condition.

"War has made necessary proper packing and proper reinforcement of round and flat steel strapping on all types of shipments. In many instances, harbor facilities are not available at invasion points. Supplies, therefore, are subject to excessive rough handling, and the factor of added strapping reinforcement has proved to be of the greatest importance in assuring satisfactory arrival condition at destination of all kinds of shipments.

"In the past year palletizing of individual shipping units has gained tremendous favor in view of the fact it cuts down time of loading and unloading freight cars, saves manpower, and cuts down the holding time of freight cars at loading and unloading platforms. The armed forces have made overseas shipments on pallets. The individual units, placed on a wooden platform and tied compactly with round or flat steel strapping range in weight from 1 to 2 tons. This method of shipping also saves a tremendous amount of time in loading and unloading ships.

"As a whole, industry during the past few years has learned the true value of round or flat strapping reinforcement for all types of containers; and the palletizing of individual units, we believe, is here to stay."

"Shark Tooth" Bucket for Slag, Limestone Bids for Attention

Arnold Hooper, manager, Bucket Sales, Blaw-Knox Co., Pittsburgh: "During recent years, there has been a steady improvement in the efficiency of clamshell buckets used in steel mills, for handling open-hearth limestone in the stock houses and slag from the pits in back of the furnaces and from the cinder recovery yards and skull cracker pits.

"Contributing to this improvement is the use of special bucket teeth somewhat similar to the dipper type teeth used on power shovel dipper. They are known as 'Shark Teeth'. Like fingers, these literally work their way between the limestone pieces, gaining greater depth of penetration and, therefore, more load per grab. Furthermore, 'Shark Teeth' protect the cutting edges of the lips from abrasive wear. Buckets so equipped handle considerably more limestone than buckets equipped with conventional teeth. Their use also results in a marked improvement in handling open-hearth slag."

War Demand and Reconversion To Stimulate Conveyor Output

F. E. Moore, president, Mathews Conveyer Co., Ellwood City, Pa.: "The most significant single development in our field during the past 12 months probably has been the very important task of designing and building much of the equipment necessary for handling heavy ordnance, especially the 240 millimeter and 8-inch shell. With the plants having contracts for these units striving desperately to get into production, speed has been very essential.

"The conveyor people were faced with many problems, some of which were unusually difficult. The unit loads were very heavy and handling them through manufacture has required many special devices which had been unnecessary in the production of lighter ordnance. I believe that I can say, without reserva-

(*Please turn to Page* 368)

PRIVATE ENTERPRISE

Faces Testin

WORK
WORK FOR ALL
8,000 UNEMPLOYED ENGINEERS DEMAND A SQUARE DEAL
IS THIS WORTH FIGHTING FOR ?
L.A.P.
L.A.P. WORKERS DEMAND FULL USE OF PLANT WORKS & SKILL

By VINCENT DELPORT
European Editor, STEEL

Old fight between capitalism and socialism given impetus by wartime conditions. Conflict growing in Britain between those favoring state control of industry and those upholding theory of private initiative

...tin Europe

WAR IN Europe reached its climax during the second half of 1944 and the end is within sight. The outcome, when Japan has also been brought to her knees, will be the overthrow of the system of personal dictatorship and the eradication of its roots.

Concurrently with this result, definite action will have to be taken to lay the foundations of a saner world, and to remove once and for all the possibility of war minded nations inflicting another war on mankind. If these objects are not achieved this war will have been fought in vain.

Apart, however, from the war between nations which is being fought to a finish to preserve the independence of freedom loving peoples, another conflict has been emerging, a conflict of ideas which has developed away from the battlefields, and which has arisen within the nations themselves.

Reference is made to the opposition that has been growing between those sections of a community that propound that industry and trade should be controlled by the government, and those that retain their belief in the initiative and the stimulating action of private enterprise.

The origins of this conflict go back to prewar times, in fact it is an aspect of the old fight between capitalism and socialism, but the conditions under which a modern war must be waged have given a sudden impulse to the latest rivalry between the two creeds. That this impulse has been all in one direction is proved by the fact that in every warring nation the government has, either by enforced compulsion or by agreement with parliamentary institutions, concentrated in its hands all the levers controlling industry and trade and has thus accomplished total centralization of a nation's activities.

The conflict is dramatic because defenders of wholesale government control believe they are serving the interests of democracy by erecting a barrier against "vested interests" and more or less disguised monopolies, and against large profits being made at the expense of the wage earner and the consumer. They also believe that government control insures a more just distribution of this world's goods among the less fortunate. Controls and regulations by decree have, in fact, during the war, constituted one huge government monopoly, and it cannot be denied that restricted necessities have been fairly distributed under this system. On the other hand, those who favor the government controlled system overlook the fact that the experiment has taken place in quite abnormal circumstances, thanks to which the many deficiencies of the system have been passed over because of the overriding necessity of centralizing all war controls in order to win it.

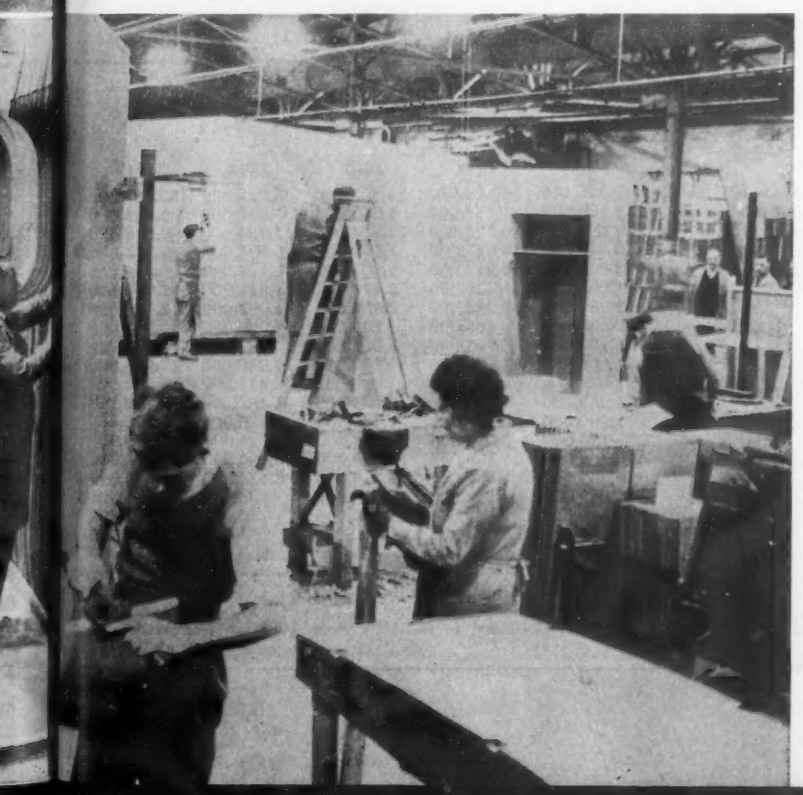
These matters are of vital interest to the steel industry because, in common with mining, transport and banking, with which the industry is closely associated, it is one of the most likely fields at first to be invaded by the extreme penetration of control, that is, nationalization or government ownership.

Before taking position on these matters certain points must be considered: Government control is a question of degree, and some control from the higher authorities is necessary if complete anarchy is to be avoided.

The extreme limit of government control is nationalization or state ownership of an industry. The trade unions in Great Britain would like to see this treatment applied to coal mining, the steel industry, public transport, banking, insurances. Owing to war contingencies the British government has, in fact, taken over certain factories; this is presumably a temporary measure which will be rescinded when the war is over. The provisional French government has taken over coal mines in the north of France and also the Renault factories; this may be a provisional measure. Already before this war, the French government had taken over the armament factories from private ownership. The greatest experiment in state ownership so far has been in Soviet Russia.

From this extreme, the state can exercise its powers through all forms and shapes of varying degree. Such powers can be extremely drastic as exemplified during the war, when the British government obtained powers from Parliament, whereby government departments could impose regulations by order under

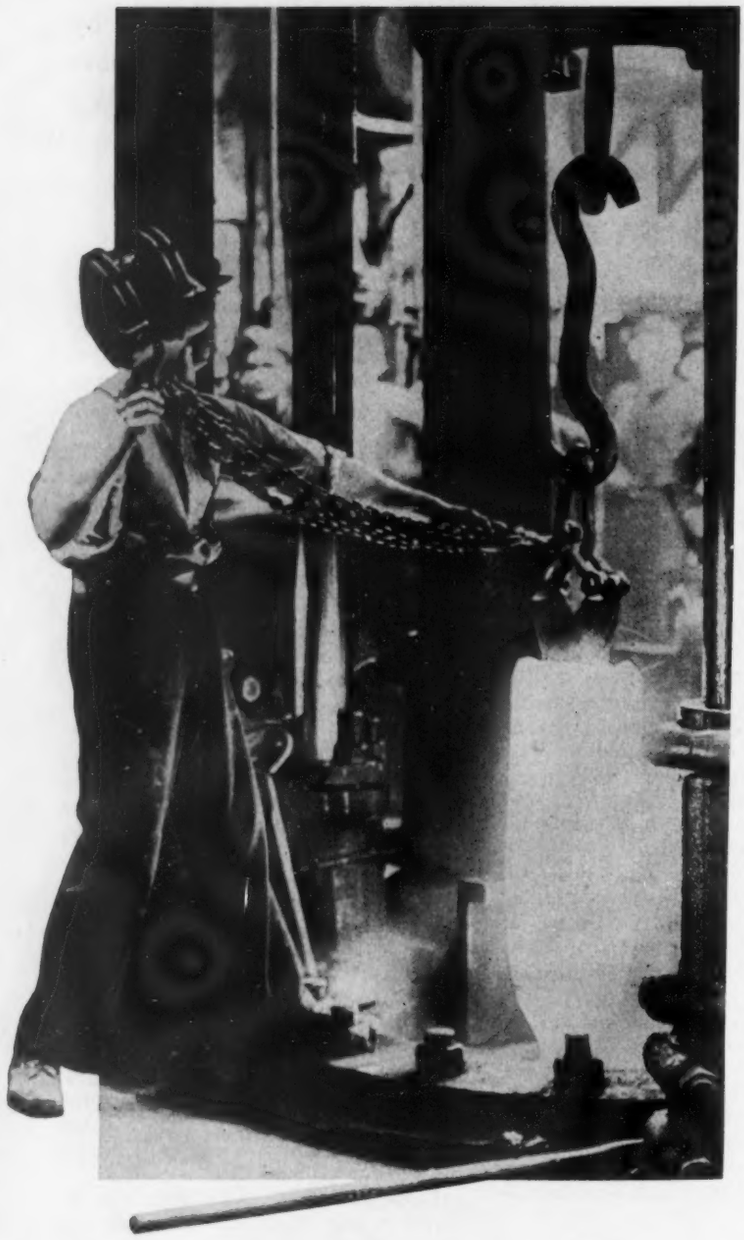
(*Please turn to Page* 349)



Hundreds of unemployed aircraft workers stage a demonstration outside the Houses of Parliament, at upper left

British workers unload prefabricated housing sections, in preparation for building shelters for persons whose homes were destroyed during bombing raids or by rockets, lower left.

At left is an unusual scene where postwar bungalows and aircraft parts are being constructed in the same factory. In the foreground, parts for Halifax bomber wings are being made; in the background sections of prefabricated houses are being constructed. NEA photos



British Steel

LOOKS AHEAD

SWIFTLY moving, epoch making events followed each other in 1944 as the Allied armies swept forward in their march towards victory. Small wonder that a wave of optimism flooded Britain bringing with it a feeling that the war was as good as over in Europe, and though further time might be needed to deal with fanatical Japan, the day for relaxation had arrived.

There has been, naturally, a reaction to that feeling, with repeated warnings from those in office—including Prime Minister Churchill who has never promised easy victory—that the end is not yet. But the knowledge that peace is in sight has served very forcibly to remind all engaged in industry, and particularly basic metals, of the problems that must be faced when the day of peace dawns and of the preparations which must be made to meet that day.

A year ago British iron and steel industry entered a state of transition. Production was equal to and in some cases in excess of requirements and adjustments were necessary in the raw material position to meet changing demands of the various government departments. It soon became clear early in 1944 that the peak

Shell blank is being formed to contour in a hydraulic press in a British plant. NEA photo

WORLD PRODUCTION OF STEEL INGOTS AND CASTINGS

Gross Tons

	1944	1943	1942	1941	1940	1939	1938	1937	1936	1929
United States	**89,815,000	88,836,366	76,812,429	73,963,624	60,518,419	47,672,195	28,693,000	51,526,000	48,525,000	56,433,000
Canada	** 3,062,000	2,701,313	2,786,929	2,411,887	1,985,000	1,300,000	1,156,000	1,352,000	1,078,000	1,391,000
Great Britain	.....	13,031,000	12,764,000	12,312,000	12,975,000	13,500,000	10,398,000	12,984,000	11,785,000	9,636,000
France	.....	.....	.....	.....	.....	8,400,000	6,087,000	7,793,000	6,601,000	9,544,000
Belgium	.....	.....	.....	.....	.....	3,000,000	2,248,000	3,801,000	3,117,000	4,066,000
Luxemburg	.....	.....	.....	.....	.....	1,800,000	1,414,000	2,470,000	1,949,000	2,659,000
Italy	.....	.....	.....	.....	.....	2,350,000	2,286,000	2,054,000	1,992,000	2,109,000
Spain	.....			.....	.....	500,000	465,000	100,000	365,000	985,000
Sweden	.....			.....	.....	1,100,000	963,000	1,088,000	962,000	683,000
Germany*	.....			.....	.....	24,000,000	22,922,000	19,531,000	18,900,000	15,986,000
Austria	.....			.....	.....	.....	.....	640,000	411,000	622,000
Czechia	.....			.....	.....	1,250,000	1,733,000	2,281,000	1,463,000	2,103,000
Poland	.....			.....	.....	1,600,000	1,517,000	1,420,000	1,123,000	1,355,000
Hungary	.....			.....	.....	750,000	638,000	654,000	543,000	505,000
Russia	.....			.....	.....	18,500,000	18,150,000	17,493,000	16,080,000	4,828,000
Japan†	.....			.....	.....	6,300,000	6,000,000	5,718,000	5,174,000	2,249,000
India	.....	.....	.....	.....	.....	1,000,000	966,000	895,000	866,000	575,000
Australia	.....	.....	.....	.....	.....	1,200,000	1,151,000	1,074,000	750,000	460,000
Saar‡	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,174,000
Miscellaneous	.....	.....	.....	.....	.....	900,000	900,000	900,000	800,000	400,000
World total	.....	.....	.....	.....	.....	134,983,000	107,687,000	133,774,000	122,484,000	118,763,000

Due to war conditions figures for 1940-44 are not available for other than Western Hemisphere countries.

*Includes Austrian production from January 1938. †Includes Manchuria and Korea. ‡Included in Germany since 1934. **Estimated.

Industry TO PEACETIME

By J. A. HORTON
British Correspondent, STEEL

Peak of war production passed early in 1944. Change in steel's position indicated by drop in semifinished imports and exportation of plates. Wartime controls are expected to be relaxed gradually

of production had been passed and during the last few months a marked decline in the placing of new contracts has been the general experience. As an instance of the change in the steel position it may be noted that plates have been exported to the United States, not that the American mills could not produce sufficient quantities, but in order to help British mills which were not able to dispose of their output. Makers of heavy structural steel are still very short of orders, though they would be the first to gain by a sudden cessation of hostilities inasmuch as reconstruction of bombed premises and rebuilding of factories would quickly absorb their capacity. Other branches which are feeling the lack of government work are the heavy engineering foundries which are not working anything like the long hours which were the rule twelve months ago when there was a scramble for raw material. Even makers of special alloy steels are noting easing of the demand for their products from aircraft manufacturers, this being accounted for by the fact that Allied air losses in recent months have been so light. In contrast to this is the steady pressure everywhere for re-rolled steels. Imports of semifinished material have been reduced and the burden of supplying the demand has returned to British steelmakers who are, however, quite capable of taking care of it.

British controlled domestic prices for iron and steel have remained unchanged.

The statistical blackout which has been in operation since 1939 has at last been lifted as far as exports are concerned though there is still no clue as to output figures for any year since the beginning of hostilities.

It is estimated, however, that the capacity of production of steel is somewhere between 16,000,000 and 16,500,000 tons for Great Britain as a whole, assuming full supplies of raw materials.

The trend of exports can be seen from a White Paper recently issued by the government giving figures for 1938, 1942 and 1943.

Exports of tin plate have been to Eire, South Africa, British India, Australia, Canada and other British countries, though some 6000 tons have been sent elsewhere.

Speaking in the House of Commons recently, Mr. Dalton, president of the Board of Trade, said the tin plate industry in Wales was out of date from the material and mechanical point of view. There would have to be new plant, new mills and new coal production plant. He

(*Please turn to Page* 358)

IRON, STEEL EXPORTS AND IMPORTS OF PRINCIPAL COUNTRIES

Thousands of gross tons—Scrap eliminated

	EXPORTS							IMPORTS						
	1943	1942	1941*	1940*	1939*	1938	1937	1943	1942	1941	1940	1939	1938	1937
United States	.....	.....	†6,337	7,785	2,499	2,149	3,472	.....	.....	24	55	285	240	452
Great Britain	133	257	487	1,077	1,582	1,918	2,576	2,660	2,432	4,033	3,570	1,702	1,341	2,039
Germany	.....	.....	.....	.....	.....	2,784	3,604	.....	.....	.....	.....	.....	867	532
France	.....	.....	.....	.....	.....	2,002	2,133	.....	.....	.....	.....	.....	92	170
Belgium & Luxemburg	.....	.....	.....	.....	.....	2,503	3,947	.....	.....	.....	.....	.....	215	428
Total	.....	.....	.....	.....	.....	11,356	15,732	.....	.....	.....	.....	.....	2,755	3,621

*Export, import figures for 1939-1941, other than United States and Great Britain, not available, due to war. †Estimated.

WORLD PRODUCTION OF PIG IRON AND FERROALLOYS

Gross Tons

	1944	1943	1942	1941	1940	1939	1938	1937	1936	1929
United States	**62,448,400	61,777,296	53,555,497	45,042,023	42,320,011	31,943,000	19,161,000	37,127,000	31,029,000	42,614,000
Canada	** 1,883,180	1,528,053	1,763,406	1,554,708	1,270,000	800,000	758,000	979,000	747,000	1,160,000
Great Britain	.....	7,187,000	7,604,000	7,392,000	8,205,000	8,200,000	6,761,000	8,493,000	7,721,000	7,589,000
France	.....	.....	.....	.....	.....	7,800,000	5,964,000	7,787,000	6,130,000	10,198,000
Belgium	.....	.....	.....	.....	.....	3,000,000	2,426,000	3,743,000	3,110,000	4,030,000
Luxemburg	.....	.....	.....	.....	.....	1,750,000	1,526,000	2,473,000	1,955,000	2,860,000
Italy	.....	.....	.....	.....	.....	1,000,000	913,000	849,000	793,000	718,000
Spain	.....			.....	.....	500,000	435,000	126,000	250,000	740,000
Sweden	.....			.....	.....	625,000	652,000	682,000	623,000	516,000
Germany*	.....			.....	.....	20,000,000	18,300,000	15,703,000	15,058,000	13,187,000
Austria	.....			.....	.....	.....	.....	383,000	244,000	455,000
Czechia	.....			.....	.....	1,000,000	1,215,000	1,648,000	1,122,000	1,618,000
Poland	.....			.....	.....	1,000,000	952,000	712,000	575,000	693,000
Hungary	.....			.....	.....	450,000	330,000	359,000	301,000	362,000
Russia	.....			.....	.....	15,000,000	14,479,000	14,288,000	14,088,000	4,253,000
Japan†	.....			.....	.....	3,250,000	3,000,000	2,758,000	2,823,000	1,491,000
India	.....	.....	.....	.....	.....	1,800,000	1,634,000	1,629,000	1,543,000	1,343,000
Australia	.....	.....	.....	.....	.....	1,100,000	1,072,000	914,000	783,000	420,000
Saar‡	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,071,000
Miscellaneous	.....	.....	.....	.....	.....	1,200,000	1,150,000	1,200,000	1,000,000	750,000
World total	.....	.....	.....	.....	.....	100,418,000	80,728,000	101,853,000	89,895,000	97,073,000

Due to war conditions figures for 1940-44 are not available for other than Western Hemisphere countries.

*Includes Austrian production from January 1938. †Includes Manchuria and Korea. ‡Included in Germany since 1934. **Estimated.

Nazi Production COLLAPSING

Deterioration of German military position during 1944 accompanied by drastic decline in output of steel and war materiel in continental Europe. Large part of production facilities destroyed by bombing or lost to Reich in Allied advance

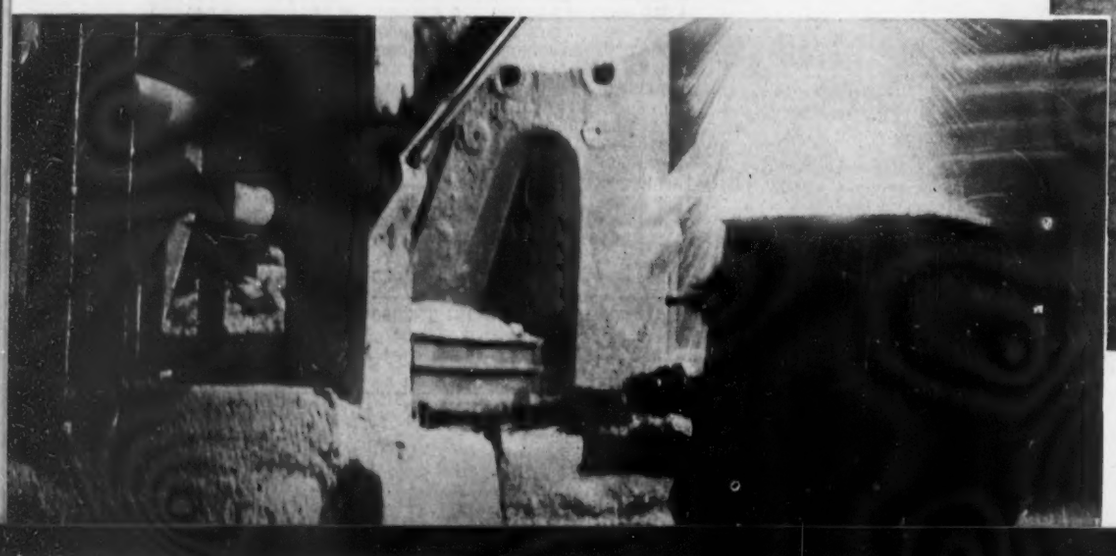
UNDER German occupation, most of the European iron and steel industry was integrated with that of the Altreicht, (prewar Germany) hence a discussion of developments in individual countries before their liberation is less easy than under peacetime conditions.

During 1944, the general position deteriorated catastrophically. By the loss of Nikopol manganese early in the winter a situation developed which alone would probably have led to an ultimate reduction in ingot output from an overall level of approximately 35 million tons to 20 million tons per annum, but further disasters followed. Supplies of other important ferroalloy materials from Turkey, the Balkans and the Iberian peninsula were severely restricted shortly afterwards and finally cut off when the Allies advanced on all fronts during the summer. Finnish nickel and molybdenum have also been lost. The long run effect of these additional losses would have been further to reduce the quality and quantity of the enemy European steel supply without the help of events connected with the Anglo-American invasion. These, however, reflected themselves much more quickly.

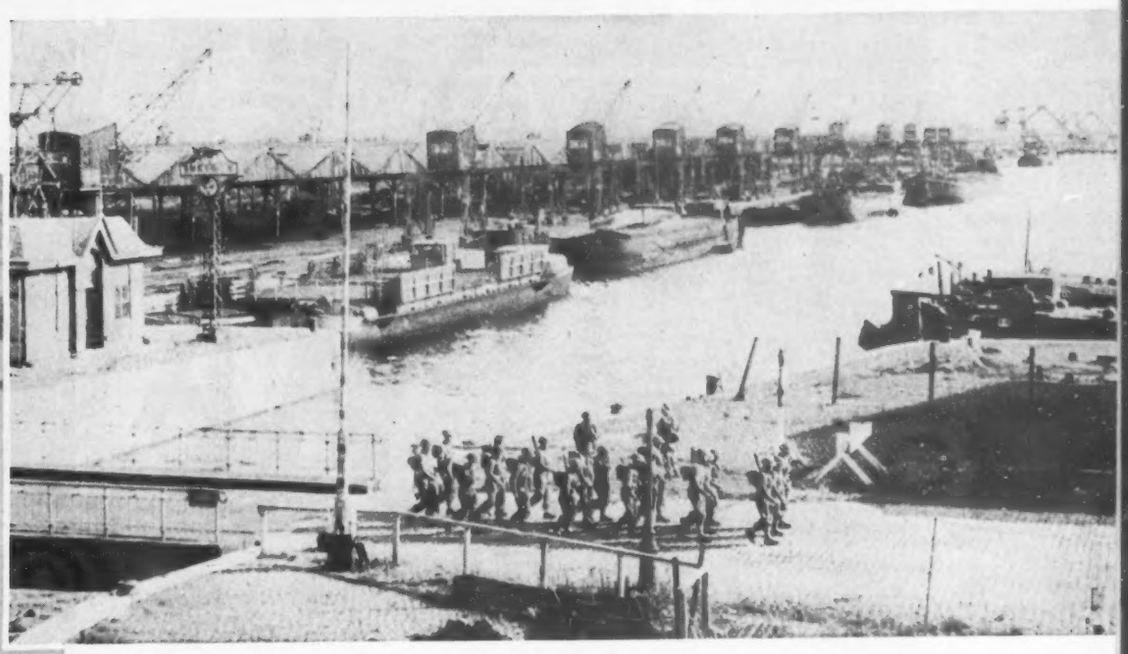
Several weeks before D-day the bombing of railways, sabotage and Germany's own military transport priorities sufficed to hold up the movement of coal, coke, ore and other raw materials in the western occupied countries so that iron and steel plants in France, Belgium and Luxemburg had to close down wholesale. Supplies of minette to the Saar and Ruhr regions of Germany proper must also have suffered. Up to the early spring, the iron and steel plants in the French Department of Moselle and Luxemburg had been operating at about the same level as in 1937, while those in the rest of France and in Belgium had operated at less than 50 per cent of the 1937 level. No recovery took place after the collapse of operations and by the late summer practically all these plants as well as the minette ore fields were recovered by the Allies.

Measures taken by the Swedes late in the summer have barred the Baltic route for Swedish ore shipments, which can now take place only in German bottoms

Slag is poured from a bessemer converter in a European steelworks, now producing girders for U. S. Engineers Corps construction on the continent. Signal Corps photo from Acme



(From an authoritative source in London)



British troops, above, move through key port of Antwerp before mounting guard over the dock area. The idle docks were captured intact. NEA photo
One of the remarkable feats of the war was the construction of prefabricated ports in England and the towing of them to Normandy to facilitate the landing of men and supplies. At left, British ambulances move along a pier roadway leading to the wharf on one of the steel ports. NEA photo

using the Narvik route on a very limited scale. It is unlikely, therefore, that Germany will obtain more than half her usual supply of Swedish ore in 1944, while in 1945 shipments will be a mere trickle.

Barred the use of Swedish and minette ore, Germany now has to rely on her own poor quality output and on that of Austria, Poland and Czechoslovakia. Because she has had the use of minette for so long, she has not developed domestic output as originally planned, hence she is unlikely to be able to produce more than enough for about 9 million tons of pig iron annually under the most favorable conditons. But the bombing of the Dortmund Ems canal has already made this more difficult because it has denied the Ruhr all its canal-borne supplies of central German ore and similarly disturbed the return movement of coke and coking coal to the other iron and steel plants.

With regard to coal and coke supplies, the problem is mainly that of transport. Coal output in the Ruhr, German and Polish Silesia and Moravia has either been maintained at the maximum prewar level or considerably increased while coke output has been maintained. In France and Holland output was at about the prewar level and in Belgium it was considerably below. Their loss to the Allies, together with that of Luxemburg, has meant a somewhat greater reduction in Axis coal and coke consumption than it has in production. The future limiting factors in enemy iron and steel output are therefore iron ore supplies and transport. It is hard to believe that a long war can be sustained on the iron and steel resources now available.

REGIONAL ACTIVITY

Activity by regions has developed during 1944 roughly as follows:

Germany Proper

Overall iron and steel output early in 1944 probably failed to reach the high level of 1938 even with the output of the new Hermann Goering works at Salzgitter because the policy was to spread operations over as wide an area of German Europe as possible. By the end of the year, output declined, particularly in the Saar and Ruhr regions, because of the advance of the Anglo-American forces and heavy bombing. There is no hope of future operations exceeding more than a small proportion of capacity in either of these regions because the former relied almost entirely on French minette and the latter on Swedish ore and minette. Output in Central Germany, Bavaria, Thuringia and Saxony has been well maintained because it is based on domestic raw materials but it may suffer through the disruption of coal and coke transport. Upper Silesian output has been at a high level, although it cannot be maintained without Swedish iron ore.

Austria

The works here have been fully employed because local ore output is ample

(*Please turn to Page* 356)

By G. H. MANLOVE
Associate Editor, STEEL

DOMESTIC MARKET SUM

Steel output in 1944 sufficient to fill war demands. Regulation of production and delivery easier than in earlier war years. Numerous strikes and general manpower shortage prevented full utilization of expanded facilities

REPEATING its performance of three prior years in filling war demands, the steel industry in 1944 fully met all consuming requirements and with increased producing capacity exceeded earlier records in providing armament for the global war. Labor, while in the main co-operating, nevertheless staged numerous strikes that interrupted production and caused the loss of many thousand tons of steel. Lack of manpower restricted production to some degree and producers were unable to give capacity service from their equipment.

Regulation of steel production and delivery was easier than in earlier war years; the Controlled Materials Plan worked more smoothly than any of its predecessors, channeling raw and finished material to most needed purposes and preventing uneven distribution. Where possible, regulations were relaxed, as in the case of pig iron, where a free market was established early in the year.

Heavy Load on Mills

Through the year mill books were heavily loaded and deliveries on current orders usually were several months in the future. Various shifts were made to provide larger supply of a product for which demand became materially heavier, as in the case of plates and sheets, both rolled on the same type of mill. Raw material supplies for steelmaking offered no important drawbacks and shortages of that kind were not the factor they were in earlier years.

Steel ingot production for 11 months exceeded output in the comparable period of 1943, though by a small margin. For this period last year ingot production totaled 82,199,288 net tons, compared with 81,581,222 tons in the prior year. Rate of operation by steelmakers was lower than in 1943, expressed in percentages of capacity, but the broader capacity base brought greater tonnage at the lower rate. While operation in the first three quarters of 1943 was at 98.1 per cent of capacity and produced 66,395,130 tons of ingots, the rate of 95.7 per cent of capacity for the first three quarters of 1944 produced 67,199,467 tons. Lack of manpower was the principal cause of the drop in rate.

Plates continued the most important product, shipbuilding being the main factor. Although it seemed in 1943 that a limit had been reached in plate output, it was exceeded in 1944, total production for nine months being 10,066,308 net tons, compared with 9,561,493 tons in the comparable period in 1943. An all-time high was reached in March with 1,222,606 tons of plates.

Toward the end of the year shipbuilding activity began to taper and it was possible to return some continuous strip mills to production of sheets and strip. For many months a great part of continuous mill capacity had been engaged in plate production at cost of sheet tonnage, demand for the latter being such that deliveries had receded far into the future. By May 1 little tonnage remained open for third quarter delivery and the War Production Board caused a shift of plate tonnage to provide more sheet capacity.

A factor in easing the sheet position was cancellation of a large tonnage for landing mats, early in October. This allowed mills to move other tonnage forward to fill gaps and delivery promises immediately were better. Later in the year sheet demand again increased and deliveries were pushed further ahead.

During the summer, after the successful invasion of France, the opinion prevailed generally that the war's end was near and that military requirements would be severely curtailed. Predictions were made that steel production would be down sharply before the end of the year. Some cancellations resulting from changed requirements of the Army and Navy lent color to this belief and the deep cut in landing mat material added to the feeling. This produced an uncertainty and some retrenchment was started as a hedge against a sudden end of the war. Representations by the War Production Board and other government agencies that production for war needs was behind schedule and that no overall cut in steel needs was in sight had some effect, which was intensified when progress of the Allied armies was slowed at the German border. Likelihood of victory before the end of the year soon disappeared.

Shell Program Enlarged

This wave of optimism brought expectation of large releases of steel for civilian purposes and the War Production Board was besieged by requests for permission to resume peacetime manufacture. However, only slight concessions were possible and nothing like the expected rate of resumption was realized. Permission was granted, among other things, for the manufacture of flatirons and innerspring mattresses in limited quantities where materials and labor were available after war materiel was fully provided but the latter provision

View in receiving yard of the Ambridge Works, American Bridge Co., U. S. Steel subsidiary. These plates, angles, channels and other structural steel units are ready to be placed in fabrication when needed

slowed production materially in civilian output.

On the other hand, progress of the European war called for additional supply of heavy shells and a program was outlined in the latter part of the year for greatly enlarged output, increasing monthly into 1945, to call for a final need of 80,000 tons per month over previous output. This stimulated the bar market, especially for larger rounds, until delivery promises late in the year were greatly deferred. At the same time larger supply of heavy trucks was demanded, which also called for more steel bars, as well as plates, sheets and castings. Difficulty of obtaining sufficient of the latter interfered with meeting schedules for this form of military supply.

Earlier opening of the navigation season on the Great Lakes and addition of several large ore carriers late in 1943 promised a record-breaking movement of Lake Superior ore in 1944 and a goal of 90,000,000 gross tons was set at the beginning. By July 1 this accomplishment seemed possible, cumulative shipments to that date totaling 42,285,902 tons, with the better half of the season remaining. However, it developed later that a smaller tonnage would suffice and some vessels were diverted from ore to grain carrying and the goal was reduced to 84,000,000 tons, later cut still further. At the close of navigation shipments totaled 81,170,538 tons, which provided sufficient reserve at lower lake docks and furnaces to meet all needs for the winter.

Pricewise the situation was unchanged for steel products, Office of Price Administration ceilings holding steady, except as a few producers were allowed premiums to balance increased costs. By Feb. 1 OPA had completed a study of steel costs submitted by steelmakers and some advances were expected to be announced within a short time. No general rise was indicated but on some products relief seemed likely. In view of demand by labor that the Little Steel formula be abrogated and an advance of 17 cents per hour be allowed to match an alleged increase in cost of living a decision on prices was deferred. Continued delay by the War Labor Board in rendering a decision on this demand held back action on prices.

In September scrap prices broke and until late December ranged below ceilings on practically all steelmaking grades, No. 1 heavy melting steel, the base grade, falling as much as $3.50 per ton from the ceiling. Cast grades, because of relative scarcity, continued at ceiling in most areas. The scrap market thus assumed nearly a normal state, with prices determined by supply and demand. After the first decline the situation leveled and strength was added as steelmakers resumed buying at the lower levels, in an effort to rebuild inventories which had been depleted when the end of the European war seemed imminent. With slowing of the Allied advance into Germany thinking was reversed and scrap stocks were rebuilt for winter demands, with material rebuilt for winter demands, with recovery almost to ceilings. Cast scrap was scarce low ceiling prices. Borings and turnings, especially alloy grades, were a drug on the market all year and disposal was difficult.

Heavy Pig Iron Output

In January Office of Price Administration authorized an increase of 50 cents per ton on by-product coke in eastern states, effective Jan. 21. This order was based on higher costs of coal and labor. Beehive oven operations fell off steadily through the year as additional by-product capacity came into operation.

Pig iron production continued its high rate and for ten months total output was 52,036,708 net tons, compared with 51,231,075 tons in the corresponding period in 1943. In March an all-time high of 5,434,240 tons was reached, passing the prior record of 5,323,738 tons set in October, 1943. Monthly production was above 5,000,000 tons through August and in September fell only a trifle short of this mark, again passing it in October. This high level was maintained in spite of larger consumption of scrap in steelmaking furnaces and a diminished melt by foundries. The latter was the result of the manpower shortage, which was extreme through the year, notably during the summer. Many important foundries

(*Please turn to Page* 347)

Pig Iron and Steel Ingot Production

Steel Ingot Figures by American Iron and Steel Institute. Coke Pig Iron by STEEL

Pig Iron Production

Net Tons

	Stacks No.	Stacks In	Output Total	Output Av. daily	Stacks No.	Stacks In	Output Total	Output Av. daily	Stacks No.	Stacks In	Output Total	Output Av. daily	Stacks No.	Stacks In	Output Total	Output Av. daily
			1929				1938				1939				1940	
Jan.	328	202	3,844,991	124,031	236	91	1,618,245	52,201	237	118	2,436,474	78,596	233	177	4,024,556	129,825
Feb.	326	208	3,604,581	128,735	236	91	1,463,093	52,254	237	121	2,307,405	82,407	233	157	3,304,368	118,943
Mar.	326	213	4,154,660	134,021	236	90	1,646,636	53,117	237	123	2,680,446	86,465	233	152	3,270,575	105,502
Apr.	326	216	4,102,747	136,759	236	79	1,554,569	51,819	236	102	2,301,965	76,732	233	155	3,139,043	104,635
May	325	220	4,366,145	140,843	236	73	1,412,249	45,556	236	106	1,923,625	62,052	233	171	3,497,157	112,811
June	325	220	4,160,917	138,697	236	67	1,188,037	39,601	235	117	2,373,753	79,125	232	181	3,813,092	127,103
July	325	217	4,236,412	136,658	236	77	1,358,645	43,827	235	129	2,638,760	85,121	231	187	4,060,513	130,984
Aug.	325	209	4,195,742	135,346	237	88	1,674,976	54,031	235	138	2,979,774	96,122	231	190	4,234,576	136,599
Sept.	323	204	3,916,029	130,534	237	97	1,885,069	62,835	235	169	3,218,940	107,298	231	192	4,172,551	139,085
Oct.	318	203	4,018,724	129,637	237	114	2,315,599	74,697	235	188	4,062,670	131,053	231	196	4,437,725	143,152
Nov.	317	176	3,564,310	118,811	236	121	2,561,060	85,369	235	191	4,166,512	138,883	231	202	4,397,656	146,589
Dec.	316	156	3,177,347	102,495	236	115	2,478,244	79,943	233	191	4,219,718	136,119	231	202	4,542,864	146,544
Total			47,342,605	*129,705			21,156,422	*57,962			35,310,042	*96,740			46,894,676	*128,128
			1941				**1942				**1943				**1944	
Jan.	229	205	4,666,233	150,524	...	...	5,061,380	.....	...	...	5,194,245	.....	...	...	5,281,464	.....
Feb.	229	202	4,206,826	150,244	...	...	4,578,629	.....	...	...	4,766,001	.....	...	...	5,088,013	.....
Mar.	229	205	4,702,905	151,707	...	...	5,134,009	.....	...	...	5,314,201	.....	...	...	5,439,240	.....
Apr.	229	191	4,340,555	144,685	...	...	4,974,960	.....	...	...	5,035,178	.....	...	...	5,248,410	.....
May	229	206	4,596,113	148,262	...	...	5,151,771	.....	...	...	5,177,728	.....	...	...	5,347,866	.....
June	229	211	4,551,040	151,701	...	...	5,014,062	.....	...	...	4,836,283	.....	...	...	5,061,621	.....
July	229	212	4,766,216	153,749	...	...	5,129,300	.....	...	...	5,022,745	.....	...	...	5,161,814	.....
Aug.	229	215	4,784,639	154,343	...	...	5,087,235	.....	...	...	5,314,633	.....	...	...	5,215,222	.....
Sept.	230	219	4,721,337	157,378	...	...	5,015,601	.....	...	...	5,225,516	.....	...	...	4,992,883	.....
Oct.	230	216	4,860,033	156,775	...	...	5,314,739	.....	...	...	5,323,738	.....	...	...	5,200,175	.....
Nov.	231	217	4,707,194	156,906	...	...	5,161,978	.....	...	...	5,333,303	.....	...	...	†5,211,692	.....
Dec.	232	218	5,014,995	161,774	...	...	5,279,580	.....	...	...	5,212,918	.....	...	...	†5,200,000	.....
Total			55,918,086	153,200			60,903,304	.....	...	...	61,777,296	.....	...	...	†62,448,400	.....

*Average. **Figures by American Iron and Steel Institute. †Estimated.

Steel Ingot Production and Operating Rates

Net Tons

	1929 Total	1929 Weekly Av.	% of Capacity	1938 Total	1938 Weekly Av.	% of Capacity	1939 Total	1939 Weekly Av.	% of Capacity	1940 Total	1940 Weekly Av.	% of Capacity
Jan.	5,040,147	1,137,731	86.84	1,942,265	438,434	29.17	3,578,863	807,870	52.83	5,764,723	1,301,292	83.4
Feb.	4,848,159	1,212,039	92.51	1,901,146	475,287	31.63	3,368,915	842,229	55.07	4,525,797	1,093,188	70.0
Mar.	5,676,357	1,281,845	97.80	2,244,708	506,706	33.72	3,839,127	866,620	56.67	4,389,183	990,786	63.5
Apr.	5,544,059	1,292,322	98.64	2,149,327	501,008	33.34	3,352,774	781,532	51.11	4,100,474	955,821	61.2
May	5,920,596	1,336,478	102.01	2,016,982	455,301	30.30	3,295,164	743,829	48.64	4,967,782	1,121,395	71.8
June	5,491,310	1,280,026	97.70	1,828,784	426,290	28.36	3,523,880	821,417	53.71	5,657,443	1,318,751	84.5
July	5,432,653	1,229,107	93.82	2,211,235	500,279	33.29	3,564,827	806,522	52.74	5,724,625	1,295,164	83.0
Aug.	5,531,776	1,247,708	95.31	2,841,554	641,434	42.68	4,241,994	957,561	62.62	6,186,383	1,396,475	89.5
Sept.	5,071,233	1,184,868	90.44	2,964,785	692,707	46.09	4,769,468	1,114,362	72.87	6,056,246	1,415,011	90.6
Oct.	5,078,445	1,146,376	87.50	3,478,703	785,260	52.25	6,080,177	1,372,500	89.75	6,644,542	1,499,897	96.1
Nov.	3,943,644	919,265	70.17	3,985,367	928,990	61.81	6,147,783	1,433,050	93.71	6,469,107	1,507,950	96.6
Dec.	3,251,373	735,605	56.15	3,506,436	793,312	52.79	5,822,014	1,317,198	86.13	6,495,357	1,469,538	94.1
Total	60,829,752	1,166,661	89.05	31,071,292	595,921	39.65	51,584,986	989,355	64.70	*66,981,662	1,281,210	82.1

	1941 Total	1941 Weekly Av.	% of Capacity	1942 Total	1942 Weekly Av.	% of Capacity	1943 Total	1943 Weekly Av.	% of Capacity	1944 Total	1944 Weekly Av.	% of Capacity
Jan.	6,922,352	1,562,608	96.8	7,112,106	1,605,442	94.5	7,424,522	1,675,964	96.8	7,586,740	1,712,582	95.6
Feb.	6,230,354	1,557,589	96.5	6,512,535	1,628,134	95.9	6,824,604	1,706,151	98.5	7,188,317	1,736,308	96.9
Mar.	7,124,003	1,608,127	99.6	7,392,111	1,668,648	98.2	7,674,578	1,732,410	100.0	7,820,226	1,765,288	98.5
Apr.	6,754,179	1,574,401	97.6	7,121,291	1,659,975	97.7	7,373,703	1,718,812	99.3	7,588,023	1,768,770	98.7
May	7,044,565	1,590,195	98.5	7,382,578	1,666,496	98.1	7,549,691	1,704,219	98.4	7,696,655	1,737,394	97.0
June	6,792,751	1,583,392	98.1	7,015,302	1,635,269	96.3	7,039,353	1,640,875	94.8	7,228,835	1,685,043	94.1
July	6,812,224	1,541,227	93.3	7,144,958	1,616,506	94.5	7,407,876	1,675,990	96.2	7,493,083	1,695,268	94.2
Aug.	6,997,494	1,579,570	95.6	7,227,655	1,631,525	95.4	7,586,464	1,712,520	98.3	7,493,430	1,691,519	94.0
Sept.	6,811,754	1,591,531	96.3	7,057,519	1,648,953	96.4	7,514,339	1,755,687	100.7	7,229,892	1,689,227	93.9
Oct.	7,236,068	1,633,424	98.9	7,579,514	1,710,951	100.0	7,814,117	1,763,909	101.2	7,615,553	1,719,086	95.6
Nov.	6,960,885	1,622,584	98.2	7,179,812	1,673,616	97.8	7,371,975	1,718,409	98.6	7,258,534	1,691,966	94.1
Dec.	7,150,315	1,617,718	97.9	7,304,540	1,652,611	96.6	7,255,144	1,641,435	94.2	†7,615,553	†1,710,678	†95.6
Tot.	*82,836,946	1,588,741	97.3	*86,029,921	1,649,979	96.8	88,836,366	1,703,804	98.1	†89,815,000	.....	.....

Compiled by American Iron and Steel Institute. †Beginning with 1927 the Institute excluded crucible and electric ingots, which totaled 756,188 net tons in 1927, 907,232 tons in 1928, 1,073,045 tons in 1929, 688,634 tons in 1930, 461,987 tons in 1931, 270,766 tons in 1932, 47,510 tons in 1933, 405,246 tons in 1934, 607,190 tons in 1935, 866,063 tons in 1936, 913,073 tons in 1937, 524,850 tons in 1938, 952,453 tons in 1939. *Includes electric steel ingots and steel castings. Crucible steel in 1940 was 1024 tons; in 1941 it was 2313 tons; in 1942 it was 2010 tons; in 1943 it was 146 tons. †Estimated.

Average Monthly Quotations in 1944

Base or Furnace, Unless Otherwise Specified; Scrap, Delivered to Consumers

PITTSBURGH

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Structural Shapes	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c
Plates	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
Bars	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15
Cold-Finished Steel Bars	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65
Strip, Hot-Rolled	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
Strip, Cold-Rolled	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
Standard Spikes	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Plain Wire	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60
Structural Rivets	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
Hot Rolled Sheets	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
No. 24 Galvanized Sheets	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
Tin Plate, base box	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Wire Nails	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55
Steel Pipe, 1 to 3-inch, % discount (base $200 per ton)	68½%	68½%	68½%	68½%	68½%	68½%	68½%	68½%	68½%	68½%	68½%	68½%
Bessemer Pig Iron, Neville Island base	24.50c	24.50c	24.50c	24.50c	24.50c	24.50c	24.50c	24.50c	24.50c	24.50c	24.50c	24.50c
Basic Pig Iron, Neville Island base	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50
No. 2 Foundry Pig Iron, Neville Island Base	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
Malleable Pig Iron, Neville Island Base	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
Bessemer Ferrosilicon, 10 percent (Jackson co. base)	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50
Billets, Bessemer and Open-Hearth	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
Sheet Bars, Bessemer and Open-Hearth	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
Wire Rods	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Furnace Coke, spot	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Foundry Coke, spot	7.75	7.75	7.75	7.75	7.75	7.75	7.75	7.75	7.75	7.75	7.75	7.75
Heavy Melting Steel Scrap	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	19.00	16.95	17.15	20.00
Low Phosphorous Scrap	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	24.00	22.20	24.00	25.00
No. 1 Cast Scrap	20.55	20.55	20.55	20.55	20.55	20.55	20.55	20.55	20.55	17.50	19.50	20.00

CHICAGO

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Bars	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c
Plates	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
Structural Shapes	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
Rail Steel Bars	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15
Cold Rolled Sheets	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05
No. 2 Foundry and Malleable Pig Iron	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00
Lake Superior Charcoal Iron, Delivered Chicago	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34	37.34
Heavy Melting Steel Scrap	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$16.70	$18.75
Rails for Rolling	22.25	22.25	22.25	22.25	22.25	22.25	22.25	22.25	22.25	22.25	22.25	22.25
No. 1 Machinery Cast Scrap	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00

EASTERN PENNSYLVANIA

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Tank Plates, delivered Philadelphia	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c
Structural Shapes, delivered Philadelphia	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.21	2.21
Steel Bars, delivered Philadelphia	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47
Hot Rolled Sheets, delivered Philadelphia	2.27	2.27	2.27	2.27	2.27	2.27	2.27	2.27	2.27	2.27	2.27	2.27
Basic Pig Iron, delivered	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34
No. 2X Foundry Pig Iron, delivered Philadelphia	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21
Standard Low Phosphorus Pig Iron, delivered	30.74	30.74	30.74	30.74	30.74	30.74	30.74	30.74	30.74	30.74	30.74	30.74
No. 1 Heavy Melting Scrap	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$16.45	$15.50	$15.50	$18.30
No. 1 Cupola Cast Scrap	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Spiegeleisen, 20%	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00
Ferromanganese, delivered Pittsburgh	140.33	140.33	140.33	140.33	140.33	140.33	140.00	140.33	140.33	140.33	140.00	140.33

COAL TAR PRODUCTS

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Benzol, per gallon producers' plants, tank lots	15.00c	15.00c	15.00c	15.00c	15.00c	15.00c	15.00c	15.00c	15.00c	15.00c	15.00c	15.00c
Toluol, two degree, per gallon producers' plants, tank lots	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00
Solvent naphtha, per gallon producers' plants, tank lots	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00
Xylol, per gallon, producers' plants, tank lots	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00
Naphthalene, flakes and balls, per pound, producers' Plants Bbls. to Jobbers	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
Phenol, per pound, producers' plants, Less Than Car Lots	13.25	13.25	13.25	13.25	13.25	13.25	13.25	13.25	13.25	13.25	13.25	13.25
Sulphate of ammonia, per ton bulk f.o.b. Atlantic seaboard	$29.20	$29.20	$29.20	$29.20	$29.20	$29.20	$29.20	$29.20	$29.20	$29.20	$29.20	$29.20

NONFERROUS METALS

Prompt wholesale prices in cents per pound

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Tin Straits, spot New York	52.000	52.000	52.000	52.000	52.000	52.000	52.000	52.000	52.000	52.000	52.000	52.000
Copper, electrolytic, delivered, Connecticut	12.000	12.000	12.000	12.000	12.000	12.000	12.000	12.000	12.000	12.000	12.000	12.000
Zinc, prime western, East St. Louis	8.250	8.250	8.250	8.250	8.250	8.250	8.250	8.250	8.250	8.250	8.250	8.250
Lead, open market, East St. Louis	6.350	6.350	6.350	6.350	6.350	6.350	6.350	6.350	6.350	6.350	6.350	6.350
Lead, open market, New York	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500	6.500
Aluminum, ninety-nine per cent plus	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000	15.000
Antimony, Domestic, bulk, cl., f.o.b. Laredo, Tex.	14.500	14.500	14.500	14.500	14.500	14.500	14.500	14.500	14.500	14.500	14.500	14.500
Nickel, cathodes	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000	35.000

Monthly Price Averages for Twelve Years

Prices Averages for Years Prior to 1934 may be found in STEEL for January 7, 1935

ORES AND ALLOYS

Per Gross Ton

Iron Ore Prices at Date of Buying Movement, Delivered Lower Lake Ports

Season	Date buying movement	Old range —Bessemer— Ton	Old range —Bessemer— Cents per unit	Old range Nonbessemer Ton	Old range Nonbessemer Cents per unit	Mesabi Bessemer Ton	Mesabi Bessemer Cents per unit	Mesabi Nonbessemer Ton	Mesabi Nonbessemer Cents per unit	Iron prices, Valley Bessemer	Iron prices, Valley No. 2 Foundry
1944		$4.75	9.223	$4.60	8.932	$4.60	8.932	$4.45	8.641	$24.00	$24.50
1943**		4.75	9.223	4.60	8.932	4.60	8.932	4.45	8.641	24.00	24.50
1942	Apr. 10, 1942	4.75	9.223	4.60	8.932	4.60	8.932	4.45	8.641	24.00	24.50
1941	Apr. 17, 1941	4.75	9.223	4.60	8.932	4.60	8.932	4.45	8.641	24.00	24.50
1940	Apr. 17, 1940*	4.75	9.223	4.60	8.932	4.60	8.932	4.45	8.641	23.50	23.00
1940	Jan. 2, 1940	5.25	10.194	5.10	9.903	5.10	9.903	4.95	9.612	23.50	23.00
1939	May 3, 1939	5.25	10.194	5.10	9.903	5.10	9.903	4.95	9.612	21.50	21.00
1938	May 23, 1938	5.25	10.194	5.10	9.903	5.10	9.903	4.95	9.612	24.50	24.00
1937	Mar. 12, 1937	5.25	10.194	5.10	9.903	5.10	9.903	4.95	9.612	24.50	24.00
1936	Apr. 3, 1936	4.80	9.320	4.65	9.029	4.65	9.029	4.50	8.738	20.00	19.50
1935	May 4, 1935	4.80	9.320	4.65	9.029	4.65	9.029	4.50	8.738	19.00	18.50
1934	May 19, 1934	4.80	9.320	4.65	9.029	4.65	9.029	4.50	8.738	19.00	18.50
1929	Mar. 22, 1929	4.80	9.320	4.65	9.029	4.65	9.029	4.50	8.738	18.50	18.00

*Price reduced. **Prices for 1943 established retroactively in December. No definite date for opening of buying movement.

Manganese Ore

Dollars Per Gross Ton, Duty Paid, Northern Atlantic Ports, on Basis of 50 Per Cent Ore

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$43.00	$43.00	$43.00	$43.00	†$40.80	$40.80	$40.80	$40.80	$40.80	$40.80	$40.80	$40.80
1943	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
1942	40.10	39.35	38.60	39.35	40.10	42.35	52.10	52.10	52.10	52.10	44.28	43.00
1941	33.03	34.85	35.60	40.10	40.10	41.60	41.60	41.60	40.85	40.10	40.10	40.10
1940	30.10	30.10	30.10	30.10	30.10	33.60	34.10	35.60	34.35	32.85	32.85	32.85
1939	20.85	20.85	20.35	20.10	20.10	20.10	20.10	20.10	Nom.	29.32	30.52	30.66
1938	28.10	28.10	28.10	28.10	28.10	28.10	25.60	25.60	25.60	22.60	21.10	21.60
1937	21.10	22.60	22.85	27.60	27.60	27.85	31.85	31.85	31.85	30.60	28.60	28.10
1936*	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	19.10	19.10	20.60
1935	23.70	23.70	23.70	23.70	23.70	23.70	23.70	23.70	23.70	23.70	23.70	23.70
1934	21.70	22.70	22.70	22.70	22.70	22.70	22.70	22.70	23.20	23.70	23.70	23.70
1929	27.70	27.70	27.70	27.70	27.70	27.70	26.70	26.70	26.70	25.70	25.70	25.70

*Effective Jan. 1, duty ½c per pound metallic content; $5.60 gross ton on 50 per cent ore. †Effective May 15, Metals Reserve Co. prices on 48% ore, Atlantic and Gulf ports, duty paid and subject to premiums, penalties and other provisions of amended MPR No. 248.

Bessemer Ferrosilicon, 10 Per Cent

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$37.50	$37.50	$37.50	$37.50	$37.50	$37.50	$37.50	$37.50	$37.50	$37.50	$37.50	$37.50
1943	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50
1942	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50	37.50
1941	34.00	34.00	34.00	34.00	34.00	34.00	37.50	37.50	37.50	37.50	37.50	37.50
1940	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00
1939	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	31.00	32.00	32.00	33.00
1938	33.00	33.00	33.00	33.00	33.00	33.00	29.00	29.00	29.00	30.00	30.00	30.00
1937	29.00	29.00	31.80	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00
1936	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	29.00
1935	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75
1934	27.25	27.25	27.25	27.25	27.75	27.75	27.75	27.75	27.75	27.75	27.75	27.75
1929	31.00	31.00	31.00	31.00	31.00	31.00	31.00	30.20	30.00	30.00	30.00	30.00

Ferrosilicon, 50 Per Cent

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$74.48	$74.48	$74.48	$74.48	$74.48	$74.48	$74.48	$74.48	$74.48	$74.48	$74.48	$74.48
1943*	74.50	74.50	74.50	74.50	74.50	74.50	74.48	74.48	74.48	74.48	74.48	74.48
1942	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50
1941	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50	74.50
1940	69.50	69.50	69.50	69.50	69.50	70.50	74.50	74.50	74.50	74.50	74.50	74.50
1939	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50
1938	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50
1937	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50
1936	77.50	77.50	77.50	77.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50	69.50
1935	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50
1934	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50	77.50
1929	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50	83.50

†Prices for last six months and all 1944 apply to eastern zone as designated by O.P.A.

Spiegeleisen, 20 Per Cent

At Producers' Furnaces

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00
1943	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00
1942	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00
1941	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00
1940	32.00	32.00	32.00	32.00	32.00	34.40	36.00	36.00	36.00	36.00	36.00	36.00
1939	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	30.00	32.00	32.00	32.00
1938	33.00	33.00	33.00	33.00	33.00	33.00	28.00	28.00	28.00	28.00	28.00	28.00
1937	26.00	26.00	28.00	30.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00
1936	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
1935	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
1934	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
1929	34.00	34.00	34.00	34.00	34.00	34.00	34.00	33.20	33.50	34.00	34.00	34.00

Ferromanganese, 80 Per Cent, del. Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$140.33	$140.33	$140.33	$140.33	$140.33	$140.33	$140.33	$140.33	$140.33	$140.33	$140.33	$140.33
1943	140.65	140.65	140.65	140.65	140.46	140.33	140.33	140.33	140.33	140.33	140.33	140.33
1942	125.33	125.33	125.33	125.33	140.65	140.65	140.65	140.65	140.65	140.65	140.65	140.65
1941	125.33	125.33	125.33	125.33	125.33	125.33	125.33	125.33	125.33	125.33	125.33	125.33
1940	105.33	105.33	105.33	105.33	105.33	105.33	125.33	125.33	125.33	125.33	125.33	125.33
1939	91.58	85.33	85.33	85.33	85.33	85.33	85.33	85.33	95.33	105.33	105.33	105.33
1938	107.49	107.49	107.49	107.49	107.77	107.77	97.77	97.77	97.77	97.77	97.83	97.83
1937	84.79	84.79	92.29	99.79	107.29	107.29	107.29	107.29	107.29	107.29	107.39	107.49
1936*	90.13	80.13	80.13	80.13	80.13	80.13	80.13	80.13	80.13	80.13	80.13	82.65
1935	89.79	89.79	89.79	89.85	90.13	90.13	90.13	90.13	90.13	90.13	90.13	90.13
1934	90.24	90.24	90.24	90.24	90.24	90.00	89.79	89.79	89.79	89.79	89.79	89.79
1929	109.79	109.79	109.79	109.79	109.79	109.79	109.79	109.79	109.79	109.79	109.79	104.79

*Duty of 1 cent per pound contained manganese became effective on ferromanganese Jan. 1, 1936.

PIG IRON

Per Gross Ton

Basic, Valley

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50	$23.50
1943	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50
1942	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50
1941	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50
1940	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	22.50	23.00
1939	20.50	20.50	20.50	20.50	20.50	20.50	20.50	20.50	21.50	22.50	22.50	22.50
1938	23.50	23.50	23.50	23.50	23.50	23.50	19.50	19.50	19.50	20.50	20.50	20.50
1937	20.50	20.50	23.10	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50
1936	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.25	20.00
1935	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	19.00	19.00
1934	17.00	17.00	17.00	17.60	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
1929	17.50	17.50	17.60	18.00	18.30	18.50	18.50	18.50	18.50	18.50	18.50	18.50

Basic, delivered Eastern Pennsylvania

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34	$25.34
1943	25.39	25.39	25.39	25.39	25.36	25.34	25.34	25.34	25.34	25.34	25.34	25.34
1942	25.34	25.34	25.36	25.39	25.39	25.39	25.39	25.39	25.39	25.39	25.39	25.39
1941	25.34	25.34	25.34	25.34	25.34	25.34	25.34	25.34	25.34	25.34	25.34	25.34
1940	24.34	24.34	24.34	24.34	24.34	24.34	24.34	24.34	24.34	24.34	24.34	24.84
1939	22.34	22.34	22.34	22.34	22.34	22.34	22.34	22.34	23.54	24.34	24.34	24.34
1938	25.34	25.34	25.34	25.34	25.34	24.69	21.34	21.34	21.34	22.34	22.34	22.34
1937	22.26	22.51	24.76	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26	25.26
1936	20.81	20.81	20.81	20.81	20.81	20.81	20.81	20.81	20.81	20.81	21.06	21.81
1935	19.76	19.76	19.76	19.76	19.81	19.81	19.81	19.81	19.81	19.81	20.81	20.81
1934	18.76	18.76	18.76	19.51	19.76	19.76	19.76	19.76	19.76	19.76	19.76	19.76
1929	20.15	20.50	20.25	20.25	20.50	20.25	19.85	19.85	19.85	19.75	19.75	19.75

No. 2 Foundry, f.o.b. Chicago

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00
1943	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1942	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1941	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1940	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.50
1939	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	22.20	23.00	23.00	23.00
1938	24.00	24.00	24.00	24.00	24.00	24.00	20.00	20.00	20.00	21.00	21.00	21.00
1937	21.00	21.00	23.20	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1936	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.75	20.50
1935	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.75	19.50	19.50
1934	17.50	17.50	17.50	18.25	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50
1929	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00

No. 2X Foundry, delivered Philadelphia

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$26.21	$26.21	$26.21	$26.21	$26.21	$26.21	$26.21	$26.21	$26.21	$26.21	$26.21	$26.21
1943	26.26	26.26	26.26	26.26	26.23	26.21	26.21	26.21	26.21	26.21	26.21	26.21
1942	26.21	26.21	26.23	26.26	26.26	26.26	26.26	26.26	26.26	26.26	26.26	26.26
1941	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21	26.21
1940	25.21	25.21	25.21	25.21	25.21	25.21	25.21	25.21	25.21	25.21	25.21	25.71
1939	23.21	23.21	23.21	23.21	23.21	23.21	23.21	23.21	24.41	25.21	25.21	25.21
1938	26.21	26.21	26.21	26.21	26.21	26.21	22.21	22.21	22.21	23.21	23.21	23.21
1937	23.14	23.39	25.64	26.14	26.14	26.14	26.14	26.14	26.14	26.14	26.14	26.14
1936	21.68	21.68	21.68	21.68	21.68	21.68	21.68	21.68	21.68	21.68	21.93	22.68
1935	20.63	20.63	20.63	20.63	20.68	20.68	20.68	20.68	20.68	20.68	21.68	21.68
1934	19.63	19.63	19.63	20.38	20.63	20.63	20.63	20.63	20.63	20.63	20.63	20.63
1929	22.26	22.01	22.26	22.26	22.76	22.76	22.76	22.26	22.26	22.26	22.26	21.76

No. 2X Foundry, f.o.b. Buffalo

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00
1943	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1942	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1941	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1940	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.50
1939	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	22.50	23.00	23.00	23.00
1938	24.00	24.00	24.00	24.00	24.00	24.00	20.00	20.00	20.00	21.00	21.00	21.00
1937	21.00	21.25	23.50	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1936	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.75	19.75
1935	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	19.50	19.50
1934	17.50	17.50	17.50	18.25	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50
1929	19.00	19.00	19.25	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00

Southern No. 2, f.o.b. Birmingham

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$20.38	$20.38	$20.38	$20.38	$20.38	$20.38	$20.38	$20.38	$20.38	$20.38	$20.38	$20.38
1943	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38
1942	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38
1941	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38
1940	19.38	19.38	19.38	19.38	19.38	19.38	19.38	19.38	19.38	19.38	19.38	19.38
1939	17.38	17.38	17.38	17.38	17.38	17.38	17.38	17.38	18.58	19.38	19.38	19.38
1938	20.38	20.38	20.38	20.38	20.38	20.38	16.38	16.38	16.38	17.38	17.38	17.38
1937	17.38	17.63	19.88	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38	20.38
1936	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.84	15.75
1935	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.75	15.50
1934	13.50	13.50	13.50	14.25	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50
1929	16.50	16.50	16.50	15.50	15.50	15.25	14.00	14.00	14.00	14.00	14.00	14.00

Malleable, f.o.b. Valley

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00	$24.00
1943	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1942	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1941	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1940	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.50
1939	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	22.00	23.00	23.00	23.00
1938	24.00	24.00	24.00	24.00	24.00	24.00	20.00	20.00	20.00	21.00	21.00	21.00
1937	21.00	21.00	23.60	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00	24.00
1936	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.50	19.75	20.50
1935	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50	19.50	19.50
1934	17.50	17.50	17.50	18.10	18.50	18.50	18.50	18.50	18.50	18.50	18.50	18.50
1929	18.00	18.00	18.10	18.50	18.80	19.00	19.00	19.00	19.00	19.00	19.00	19.00

Standard Low Phosphorus, delivered Eastern Pennsylvania

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$30.74	$30.74	$30.74	$30.74	$30.74	$30.74	$30.74	$30.74	$30.74	$30.74	$30.74	$30.74
1943	30.81	30.81	30.81	30.81	30.77	30.74	30.74	30.74	30.74	30.74	30.74	30.74
1942	30.74	30.74	30.77	30.81	30.81	30.81	30.81	30.81	30.81	30.81	30.81	30.81
1941	30.74	30.74	30.74	30.74	30.74	30.74	30.74	30.74	30.74	30.74	30.74	30.74
1940	29.74	29.74	29.74	29.74	29.74	29.74	29.74	29.74	29.74	29.74	29.74	30.24
1939	27.74	27.74	27.74	27.74	27.74	27.74	27.74	27.74	28.94	29.74	29.74	29.74
1938	29.63	29.63	29.63	29.70	29.74	29.74	26.74	26.74	26.74	27.74	27.74	27.74
1937	26.63	26.88	29.63	29.63	29.63	29.63	29.63	29.63	29.63	29.63	29.63	29.63
1936	25.13	25.13	25.13	25.13	25.13	25.13	25.13	25.13	25.13	25.13	25.38	26.13
1935	24.63	24.63	24.63	24.63	24.63	24.63	24.63	24.63	24.63	24.63	24.63	24.63
1934	24.13	24.13	24.13	24.13	24.63	24.63	24.63	24.63	24.63	24.63	24.63	24.63
1929	24.26	24.26	24.26	24.26	24.26	24.26	24.26	24.26	24.76	24.76	24.76	24.76

Lake Superior Charcoal, delivered Chicago

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$37.34	$37.34	$37.34	$37.34	$37.34	$37.34	$37.34	$37.34	$37.34	$37.34	$37.34	$37.34
1943	31.54	31.54	31.54	31.54	31.39	31.34	37.34	37.34	37.34	37.34	37.34	37.34
1942	31.34	31.34	31.44	31.54	31.54	31.54	31.54	31.54	31.53	31.54	31.54	31.54
1941	30.34	30.34	30.34	30.34	31.09	31.34	31.34	31.34	31.34	31.34	31.34	31.34
1940	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34
1939	28.34	28.34	28.34	28.34	28.34	28.34	28.34	29.54	30.34	30.34	30.34	30.34
1938	30.24	30.24	30.24	30.34	30.34	30.34	28.34	28.34	28.34	28.34	28.34	28.34
1937	26.54	26.54	28.95	30.04	30.04	30.04	30.04	30.04	30.04	30.04	30.14	30.24
1936	25.25	25.25	25.25	25.25	25.25	25.25	25.25	25.25	25.25	25.25	25.50	26.25
1935	24.04	24.04	24.04	24.15	24.25	24.25	24.25	24.25	24.25	24.90	25.25	25.25
1934	23.54	23.54	23.54	23.66	24.04	24.04	24.04	24.04	24.04	24.04	24.04	24.04
1929	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04

SEMIFINISHED STEEL

Per Gross Ton f.o.b.

Open-Hearth and Bessemer Billets, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00
1943	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
1942	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
1941	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
1940	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
1939	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
1938	37.00	37.00	37.00	37.00	37.00	37.00	34.00	34.00	34.00	34.00	34.00	34.00
1937	34.00	34.00	36.40	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00
1936	29.00	29.00	28.40	28.00	28.00	28.00	30.00	30.00	30.00	32.00	32.00	32.00
1935	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	28.50	29.00
1934	26.00	26.00	26.00	27.80	29.00	29.00	27.40	27.00	27.00	27.00	27.00	27.00
1929	33.00	34.25	34.00	34.50	36.00	35.75	35.00	35.00	35.00	35.00	35.00	34.75

Open-Hearth and Bessemer Sheet Bars, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00	$34.00
1943	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
1942	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
1941	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
1940	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
1939	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00	34.00
1938	37.00	37.00	37.00	37.00	37.00	37.00	34.00	34.00	34.00	34.00	34.00	34.00
1937	34.00	34.00	36.40	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00
1936	30.00	30.00	28.50	28.00	28.00	28.00	30.00	30.00	30.00	32.00	32.00	32.00
1935	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	29.50	30.00
1934	26.00	26.00	26.00	28.40	30.00	30.00	28.40	28.00	28.00	28.00	28.00	28.00
1929	34.00	33.25	35.00	35.25	36.00	35.75	35.00	35.00	35.00	35.00	35.00	34.75

Wire Rods, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00	$2.00
1943	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
1942	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
1941	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
1940*	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
1939	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00
1938	47.00	47.00	47.00	47.00	47.00	47.00	43.00	43.00	43.00	43.00	43.00	43.00
1937	43.00	43.00	46.20	47.00	47.00	47.00	47.00	47.00	47.00	47.00	47.00	47.00
1936	40.00	40.00	40.00	40.00	40.00	38.80	38.00	38.00	38.00	40.00	40.00	40.00
1935	38.00	38.00	38.00	38.00	38.00	38.00	38.00	38.00	38.00	38.00	38.50	40.00
1934	36.00	36.00	36.00	37.20	38.00	38.00	38.00	38.00	38.00	38.00	38.00	38.00
1929	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	40.00	40.00

*Per 100 lbs. from January, 1940.

BEEHIVE COKE

Net Ton

Foundry, Spot, Connellsville

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$7.75	$7.75	$7.75	$7.75	$7.75	$7.75	$7.75	$7.75	$7.75	$7.75	$7.75	$7.75
1943	7.25	7.50	7.75	7.75	7.75	7.75	7.75	7.75	7.75	7.75	7.75	7.75
1942	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25	7.25
1941	6.00	6.00	6.00	6.00	6.30	7.25	7.25	7.25	7.25	7.25	7.25	7.25
1940	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	6.00
1939	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.80	6.00	5.75
1938	5.25	5.25	5.25	5.25	5.25	5.05	5.00	5.00	5.00	5.00	5.00	5.05
1937	4.25	4.25	4.25	5.05	5.30	5.30	5.30	5.30	5.30	5.30	5.30	5.30
1936	4.00	4.20	4.10	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25
1935	4.60	4.60	4.60	4.60	4.60	4.60	4.25	4.00	4.00	4.35	4.35	4.25
1934	4.25	4.25	4.25	4.55	4.60	4.60	4.60	4.60	4.60	4.60	4.60	4.60
1929	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.55	3.50

Furnace, Spot, Connellsville

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$7.00	$7.00	$7.00	$7.00	$7.00	$7.00	$7.00	$7.00	$7.00	$7.00	$7.00	$7.00
1943	6.00	6.40	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
1942	6.20	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1941	5.50	5.50	5.50	5.50	5.70	6.25	6.25	6.25	6.25	6.25	6.25	6.25
1940	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.75	5.00
1939	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	4.75	5.00	5.00
1938	4.25	4.25	4.25	4.25	4.25	3.90	3.75	3.75	3.75	3.75	3.75	3.75
1937	4.00	4.00	4.05	4.50	4.85	4.65	4.50	4.50	4.45	4.40	4.37	4.37
1936	3.50	3.50	3.50	3.50	3.50	3.50	3.45	3.45	3.90	4.00	4.00	4.00
1935	3.60	3.60	3.60	3.60	3.60	3.50	3.30	3.25	3.25	3.55	3.55	3.65
1934	3.60	3.50	3.35	3.30	3.45	3.60	3.60	3.60	3.60	3.60	3.60	3.60
1929	2.75	2.90	2.95	2.75	2.75	2.75	2.75	2.75	2.65	2.65	2.65	2.65

STEEL AND IRON SCRAP

Per Gross Ton, Delivered

Heavy Melting Steel, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$19.00	$16.95	$17.15	$20.00
1943	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
1942	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
1941	22.15	20.75	20.75	20.20	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
1940	18.15	17.75	17.05	16.45	18.00	19.90	19.55	18.75	20.15	21.30	21.50	22.50
1939	15.60	15.65	15.75	15.50	14.55	15.00	15.55	16.15	18.75	23.15	21.85	18.50
1938	14.05	14.15	13.65	12.79	11.55	11.40	13.75	15.20	15.25	14.95	14.85	15.75
1937	18.95	19.65	22.40	22.75	19.00	18.40	19.40	21.85	20.40	17.15	14.10	12.75
1936	14.50	14.80	15.75	15.75	14.75	13.80	14.15	16.00	17.75	18.15	17.25	18.50
1935	13.50	13.25	12.40	11.70	12.00	12.25	12.30	13.25	13.45	13.65	13.65	14.05
1934	13.05	13.90	14.35	14.15	12.80	11.90	12.00	11.45	10.75	10.50	11.15	12.95
1929	19.00	18.60	18.50	18.60	17.85	18.30	18.45	18.90	18.45	17.30	16.30	15.10

Heavy Melting Steel, Chicago

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$17.56	$16.70	$18.75
1943	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75
1942	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75
1941	20.15	19.25	19.45	18.80	18.75	18.75	18.75	18.74	18.75	18.75	18.75	18.75
1940	16.45	15.75	15.50	15.25	16.65	18.00	17.45	18.15	19.30	19.85	20.25	20.60
1939	13.75	14.00	14.25	13.35	12.75	13.38	13.55	13.75	16.05	19.25	17.45	16.25
1938	13.25	12.15	12.20	11.45	11.05	10.25	12.05	14.00	15.60	13.05	14.20	15.75
1937	18.25	19.50	20.90	20.75	17.55	16.00	17.75	19.75	17.85	13.95	12.55	11.50
1936	13.40	14.30	14.75	14.35	13.05	12.75	13.25	15.45	16.15	16.25	16.50	16.50
1935	12.15	11.65	10.45	10.05	10.20	10.25	10.40	12.35	12.55	12.50	13.20	13.75
1934	10.44	10.87	12.00	11.75	11.13	9.75	9.55	9.25	8.65	8.75	9.00	10.15
1929	16.50	16.00	15.55	15.95	15.45	14.95	14.75	15.05	15.05	14.45	15.05	12.50

Heavy Melting Steel, Eastern Pennsylvania

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$18.75	$16.45	$15.50	$15.50	$18.30
1943	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75
1942	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75
1941	20.56	20.00	20.00	19.06	18.75	18.75	18.75	18.75	18.75	18.75	18.75	18.75
1940	18.15	17.50	17.15	16.75	17.40	19.65	19.05	19.75	20.70	20.75	20.75	20.75
1939	15.25	15.25	15.37	15.65	15.25	15.44	15.60	16.44	18.95	22.12	20.70	18.85
1938	14.95	14.75	14.44	13.45	12.25	11.85	13.72	14.50	14.25	14.65	14.75	15.20
1937	17.50	18.75	19.75	20.44	18.40	17.03	18.40	19.75	19.22	16.55	14.00	14.00
1936	12.37	13.15	13.46	13.75	12.65	11.70	12.25	13.85	15.37	15.65	14.81	15.63
1935	11.40	11.25	10.60	10.15	10.45	10.45	10.30	11.40	12.20	12.00	12.05	12.25
1934	11.63	11.73	11.70	11.50	11.00	10.40	10.25	9.85	9.60	9.50	9.95	10.85
1929	16.50	16.30	16.25	17.00	16.25	16.25	16.50	16.75	16.37	15.80	15.15	14.50

Compressed Sheets, Detroit (Dealers)

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$17.85	$17.85	$17.85	$17.85	$17.85	$17.85	$17.85	$17.85	$14.25	$11.75	$12.25	$13.25
1943	17.85	17.85	17.85	17.85	17.85	18.85	17.85	17.85	17.85	17.85	17.85	17.85
1942	17.85	17.85	17.85	17.85	17.85	17.85	17.85	17.85	17.85	17.85	17.85	17.85
1941	19.20	17.90	17.70	17.85	17.85	17.85	17.85	17.85	17.85	17.85	17.85	17.85
1940	13.90	13.65	13.25	13.75	15.65	17.70	16.60	17.25	17.90	18.40	18.15	18.50
1939	11.95	12.00	12.10	11.50	10.55	11.05	11.95	12.75	14.80	18.25	17.40	14.45
1938	10.50	10.50	9.95	8.45	7.60	7.30	10.20	11.45	11.85	11.65	11.80	11.90
1937	15.75	16.10	18.25	19.15	16.55	15.50	17.00	18.25	17.95	14.15	10.40	10.30
1936	10.45	11.55	12.50	12.10	10.85	10.50	11.05	12.75	14.25	14.40	13.60	13.95
1935	10.00	9.60	7.95	7.75	7.95	8.50	8.75	9.80	10.05	10.05	9.75	9.90
1934	8.50	9.40	10.30	9.70	8.90	7.90	8.00	7.80	7.75	7.50	7.75	9.00
1929	14.65	14.45	14.00	14.00	14.00	13.65	14.00	14.00	14.00	13.40	12.15	11.50

No. 1 Cast, Eastern Pennsylvania

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00
1943	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
1942	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
1941	24.25	24.25	25.10	25.10	23.00	23.00	23.00	23.00	23.00	23.00	23.00	22.25
1940	20.75	19.75	19.70	19.70	20.40	21.65	21.50	21.65	22.25	22.50	22.95	23.25
1939	16.75	16.75	16.75	16.50	16.25	16.25	16.35	16.90	19.75	23.50	22.25	20.95
1938	16.25	16.20	15.75	15.30	14.75	14.75	15.85	16.75	16.75	16.75	16.75	16.75
1937	18.85	19.00	20.69	22.50	20.35	18.81	19.55	21.65	20.50	18.95	16.75	16.25
1936	12.75	13.45	17.00	14.88	14.15	13.75	14.31	15.55	16.62	16.65	16.25	17.75
1935	11.60	11.95	11.75	11.55	11.50	11.50	11.50	11.60	12.25	12.25	12.75	12.75
1934	11.50	11.65	12.30	12.50	12.15	12.00	11.25	11.00	11.00	11.00	11.00	12.25
1929	16.75	16.75	16.50	16.50	16.50	16.50	16.50	16.50	16.25	16.25	16.00	16.00

Cast Borings, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$16.00	$16.00	$16.00	$16.00	$16.00	$16.00	$16.00	$16.00	$15.25	$11.50	$11.90	$14.00
1943	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
1942	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
1941	15.40	15.50	16.80	15.90	15.30	15.25	15.25	15.25	15.25	15.25	15.25	15.25
1940	12.00	9.65	8.50	8.85	9.65	10.75	11.40	12.50	13.40	14.00	14.25	15.50
1939	8.25	8.25	8.55	8.75	7.35	6.75	8.10	8.95	10.00	12.50	13.80	12.35
1938	7.25	7.25	6.75	6.25	6.25	5.90	7.05	7.75	8.15	8.65	8.50	8.50
1937	14.40	14.00	14.40	14.50	14.10	14.00	14.65	15.20	14.90	12.95	8.75	7.25
1936	8.30	8.75	8.70	8.75	8.75	8.05	7.90	10.90	11.95	11.65	11.50	13.00
1935	6.50	6.90	7.00	6.10	6.00	6.65	6.50	7.00	7.30	8.15	8.15	8.00
1934	7.30	8.15	8.70	8.50	8.25	7.75	7.25	7.05	6.25	5.50	5.90	6.00
1929	12.55	12.25	11.50	12.15	11.55	11.85	12.10	12.50	12.40	11.80	11.15	10.75

Machine Shop Turnings, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$15.00	$15.00	$15.00	$15.00	$15.00	$15.00	$15.00	$15.00	$10.50	$ 9.80	$ 9.90	$12.00
1943	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
1942	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00
1941	15.25	15.25	15.70	15.65	15.50	15.50	15.50	15.50	15.50	15.50	15.50	15.50
1940	12.50	10.90	10.45	10.10	11.65	13.50	14.10	14.00	15.40	15.50	15.50	16.25
1939	9.50	9.50	9.65	9.75	8.50	8.25	9.15	10.15	11.65	14.60	14.75	13.15
1938	8.00	8.85	7.75	7.05	6.75	6.30	7.85	9.25	9.45	9.65	9.70	10.00
1937	14.15	14.25	15.55	15.25	14.80	14.00	14.05	15.05	14.75	11.75	8.55	7.25
1936	9.75	10.20	10.50	10.50	9.75	9.40	9.50	10.70	12.40	12.45	11.75	12.90
1935	8.95	8.80	7.40	7.40	8.15	8.25	8.15	8.80	9.55	9.70	9.45	9.65
1934	9.05	10.00	10.75	10.15	8.20	7.45	7.50	8.00	7.30	7.00	7.20	8.50
1929	12.50	11.25	10.65	11.05	11.00	11.35	11.85	12.40	12.00	11.40	10.75	10.25

FINISHED STEEL

Per Pound f. o. b.

Steel Bars, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c
1943	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15
1942	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15
1941	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15
1940	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15
1939	2.25	2.25	2.25	2.25	2.20	2.15	2.15	2.15	2.15	2.15	2.15	2.15
1938	2.45	2.45	2.45	2.45	2.45	2.45	2.25	2.25	2.25	2.25	2.25	2.25
1937	2.20	2.20	2.40	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45
1936	1.85	1.85	1.85	1.85	1.85	1.85	1.95	1.95	1.95	2.05	2.05	2.05
1935	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.85	1.85	1.85	1.85
1934	1.75	1.75	1.75	1.85	1.90	1.90	1.80	1.80	1.80	1.80	1.80	1.80
1929	1.90	1.90	1.90	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90	1.90

Tank Plates, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c
1943	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1942	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1941	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1940	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1939	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1938	2.25	2.25	2.25	2.25	2.25	2.25	2.10	2.10	2.10	2.10	2.10	2.10
1937	2.05	2.05	2.20	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
1936	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1935	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80
1934	1.70	1.70	1.70	1.80	1.85	1.85	1.80	1.80	1.80	1.80	1.80	1.80
1929	1.90	1.90	1.90	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90

Structural Shapes, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c
1943	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1941	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1940	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1939	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1938	2.25	2.25	2.25	2.25	2.25	2.25	2.10	2.10	2.10	2.10	2.10	2.10
1937	2.05	2.05	2.20	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
1936	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1935	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80
1934	1.70	1.70	1.70	1.80	1.85	1.85	1.80	1.80	1.80	1.80	1.80	1.80
1929	1.90	1.90	1.90	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90

Hot Rolled Sheets, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c
1943	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1942	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1941	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1940	2.10	2.10	2.10	1.98	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1939	2.15	2.15	2.15	2.15	2.05	2.00	2.00	2.00	2.00	2.00	2.00	2.10
1938	2.40	2.40	2.40	2.40	2.40	2.40	*2.15	2.15	2.15	2.10	2.15	2.15
1937	2.15	2.15	2.35	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
1936	1.85	1.85	1.85	1.85	1.85	1.85	1.95	1.95	1.95	1.95	1.95	2.10
1935	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85
1934	1.75	1.75	1.75	1.90	2.00	2.00	1.85	1.85	1.85	1.85	1.85	1.85
1929	2.10	2.10	2.10	2.15	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.15

*Succeeded No. 10 blue annealed June 24, 1938.

Cold Rolled Sheets, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c
1943	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05
1942	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05
1941	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05
1940	3.05	3.05	3.05	2.93	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05
1939	3.20	3.20	3.20	3.20	3.10	3.05	3.05	3.05	3.05	3.05	3.05	3.05
1938	3.55	3.45	3.45	3.45	3.45	3.45	3.20	3.20	3.20	3.20	3.20	3.20
1937	3.25	3.25	3.50	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55
1936	2.95	2.95	2.95	2.95	2.95	2.95	3.05	3.05	3.05	3.05	3.05	3.05
1935	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95
1934	2.75	2.75	2.75	3.05	3.15	3.10	2.95	2.95	2.95	2.95	2.95	2.95
1929	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.05	4.00	4.00

No. 24 Galvanized Sheets, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c
1943	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1942	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1941	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1940	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1939	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1938	3.80	3.80	3.80	3.80	3.80	3.75	3.50	3.50	3.50	3.50	3.50	3.50
1937	3.40	3.40	3.70	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80
1936	3.10	3.10	3.10	3.10	3.10	3.10	3.20	3.20	3.20	3.20	3.20	3.35
1935	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10
1934	2.85	2.85	2.85	3.10	3.25	3.25	3.10	3.10	3.10	3.10	3.10	3.10
1929	3.60	3.60	3.60	3.65	3.70	3.65	3.60	3.55	3.50	3.50	3.45	3.40

Cold Finished Steel Bars, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	2.65c	2.65c	2.65c	2.65c	2.65c	2.65c	2.65c	2.65c	2.65c	2.65c	2.65c	2.65c
1943	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65
1942	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65
1941	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.62	2.65	2.65
1940	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65
1939	2.70	2.70	2.70	2.70	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65
1938	2.90	2.90	2.90	2.90	2.90	2.90	2.70	2.70	2.70	2.70	2.70	2.70
1937	2.55	2.55	2.85	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90
1936	2.10	2.10	2.10	2.10	2.10	2.15	2.25	2.25	2.25	2.35	2.35	2.55
1935	2.10	2.10	2.10	2.00	1.95	1.95	1.95	1.95	1.95	1.95	1.95	2.05
1934	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1929	2.20	2.20	2.25	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.20	2.20

Tin Plate, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00
1943	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1942	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1941	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1940	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1939	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1938	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	*5.10	5.00
1937	4.85	4.85	4.85	5.25	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35
1936	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25
1935	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25
1934	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25	5.25
1929	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35	5.35

*Refund of 25 cents per box on all contracts Jan. 1 to Nov. 10, 1938.

Cold Rolled Strip, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	2.80c	2.80c	2.80c	2.80c	2.80c	2.80c	2.80c	2.80c	2.80c	2.80c	2.80c	2.80c
1943	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
1942	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
1941	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
1940	2.80	2.80	2.80	2.68	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80
1939	2.95	2.95	2.95	2.95	2.85	2.80	2.80	2.80	2.80	2.80	2.80	2.80
1938	3.20	3.20	3.20	3.20	3.20	3.10	2.95	2.95	2.95	2.90	2.90	2.90
1937	2.85	2.85	3.15	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
1936	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.80
1935	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60
1934	2.40	2.40	2.40	2.65	2.80	2.80	2.60	2.60	2.60	2.60	2.60	2.60
1929	2.85	2.85	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75

Hot Rolled Strip, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c	2.10c
1943	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1942	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1941	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1940	2.10	2.10	2.10	1.98	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
1939	2.15	2.15	2.15	2.15	2.05	2.00	2.00	2.00	2.00	2.00	2.00	2.10
1938	2.40	2.40	2.40	2.40	2.40	2.40	2.15	2.15	2.15	2.10	2.10	2.10
1937	2.15	2.15	2.35	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
1936	1.85	1.85	1.85	1.85	1.85	1.85	1.95	1.95	1.95	1.95	1.95	2.10
1935	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85
1934	1.75	1.75	1.75	1.95	2.00	2.00	1.85	1.85	1.85	1.85	1.85	1.85
1929	1.80	1.85	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90

Plain Wire, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c	2.60c
1943	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60
1942	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60
1941	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60
1940	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60
1939	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60
1938	2.90	2.90	2.90	2.90	2.90	2.90	2.60	2.60	2.60	2.60	2.60	2.60
1937	2.60	2.60	2.85	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90
1936	2.30	2.30	2.30	2.40	2.40	2.40	2.40	2.40	2.40	2.50	2.50	2.60
1935	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
1934	2.20	2.20	2.20	2.25	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
1929	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.45	2.40	2.40	2.40

Wire Nails, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c	2.55c
1943	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55
1942	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55
1941	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55
1940	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55	2.55
1939	2.45	2.45	2.45	2.45	2.45	2.45	2.40	2.40	2.40	2.50	2.55	2.55
1938	2.75	2.75	2.75	2.75	2.75	2.75	2.45	2.45	2.45	2.45	2.45	2.45
1937	2.25	2.25	2.70	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75
1936	2.40	2.40	2.15	2.10	2.10	2.10	2.10	2.10	1.95	2.05	2.05	2.20
1935	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.55	2.40	2.40	2.40	2.40
1934	2.85	2.85	2.85	2.50	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60
1929	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.65	2.50	2.45	2.40	2.40

Rail Steel Bars, Chicago

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c	2.15c
1943	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15
1942	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15
1941	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15
1940	2.15	2.15	2.10	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.10	2.10
1939	2.10	2.10	2.10	2.10	2.05	2.00	2.00	2.00	2.03	2.15	2.15	2.15
1938	2.35	2.35	2.35	2.35	2.35	2.35	2.15	2.10	2.10	2.10	2.10	2.10
1937	2.10	2.10	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35	2.35
1936	1.75	1.75	1.75	1.75	1.75	1.75	1.85	1.85	1.85	1.95	1.95	1.95
1935	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75
1934	1.70	1.70	1.70	1.79	1.85	1.85	1.77	1.75	1.75	1.75	1.75	1.75
1929	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.95	1.90

Structural Rivets, Pittsburgh

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	3.75c	3.75c	3.75c	3.75c	3.75c	3.75c	3.75c	3.75c	3.75c	3.75c	3.75c	3.75c
1943	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
1942	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
1941	3.40	3.40	3.40	3.40	3.50	3.75	3.75	3.75	3.75	3.75	3.75	3.75
1940	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40
1939	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40
1938	3.60	3.60	3.60	3.60	3.60	3.60	3.40	3.40	3.40	3.40	3.40	3.40
1937	3.25	3.25	3.45	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60
1936	2.90	2.90	2.90	2.90	2.90	2.95	3.05	3.05	3.05	3.05	3.05	3.20
1935	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90
1934	2.75	2.75	2.75	2.90	3.00	3.00	2.95	2.90	2.90	2.90	2.90	2.90
1929	2.85	2.90	2.95	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10	3.10

Cast Iron Pipe, Birmingham

6-Inch and larger, per net ton

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1944	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00	$45.00
1943	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00
1942	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00
1941	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00
1940	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00
1939	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	45.00	45.00	45.00
1938	46.00	46.00	46.00	46.00	46.00	46.00	42.60	42.00	42.00	42.00	42.00	42.00
1937	41.00	41.00	44.75	46.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00	46.00
1936	39.00	39.00	39.00	39.00	39.00	39.00	39.00	39.00	39.00	39.00	39.00	41.00
1935	38.00	38.00	38.00	38.50	39.00	39.00	39.00	39.00	39.00	39.00	39.00	39.00
1934	36.00	36.00	36.00	36.00	36.00	36.40	38.00	38.00	38.00	38.00	38.00	38.00
1929	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00	37.00

Steel, Iron and Scrap Price Composites

Compiled by STEEL

Finished Steel Price Composite

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yr's Av.
1944	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73
1943	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73
1942	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73
1941	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73
1940	56.73	56.73	56.73	56.08	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.73	56.68
1939	57.36	57.36	57.36	57.36	56.74	56.36	56.29	56.27	56.27	56.49	56.54	56.73	56.76
1938	62.18	62.05	62.00	62.00	62.00	61.45	58.00	58.00	58.00	57.78	57.52	57.36	59.86
1937	55.18	55.18	60.14	61.95	62.18	62.18	62.18	62.18	62.18	62.18	62.18	62.18	60.82

Average of industry-wide prices on sheet, strip, bars, plates, shapes, wire, nails, tin plate, standard and line pipe.

Semifinished Steel Price Composite

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yr's Av.
1944	$36.00	$35.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00	$36.00
1943	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00
1942	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00
1941	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00
1940	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00
1939	36.60	36.60	36.60	36.60	36.60	36.60	36.60	36.60	36.60	36.60	36.60	36.15	36.56
1938	40.00	40.00	40.00	40.00	40.00	40.00	36.60	36.60	36.60	36.60	36.60	36.60	38.30
1937	36.20	36.20	39.24	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	39.30

Average of industry-wide prices on billets, slabs, sheet bars, skelp and wire rods.

Steelmaking Pig Iron Price Composite

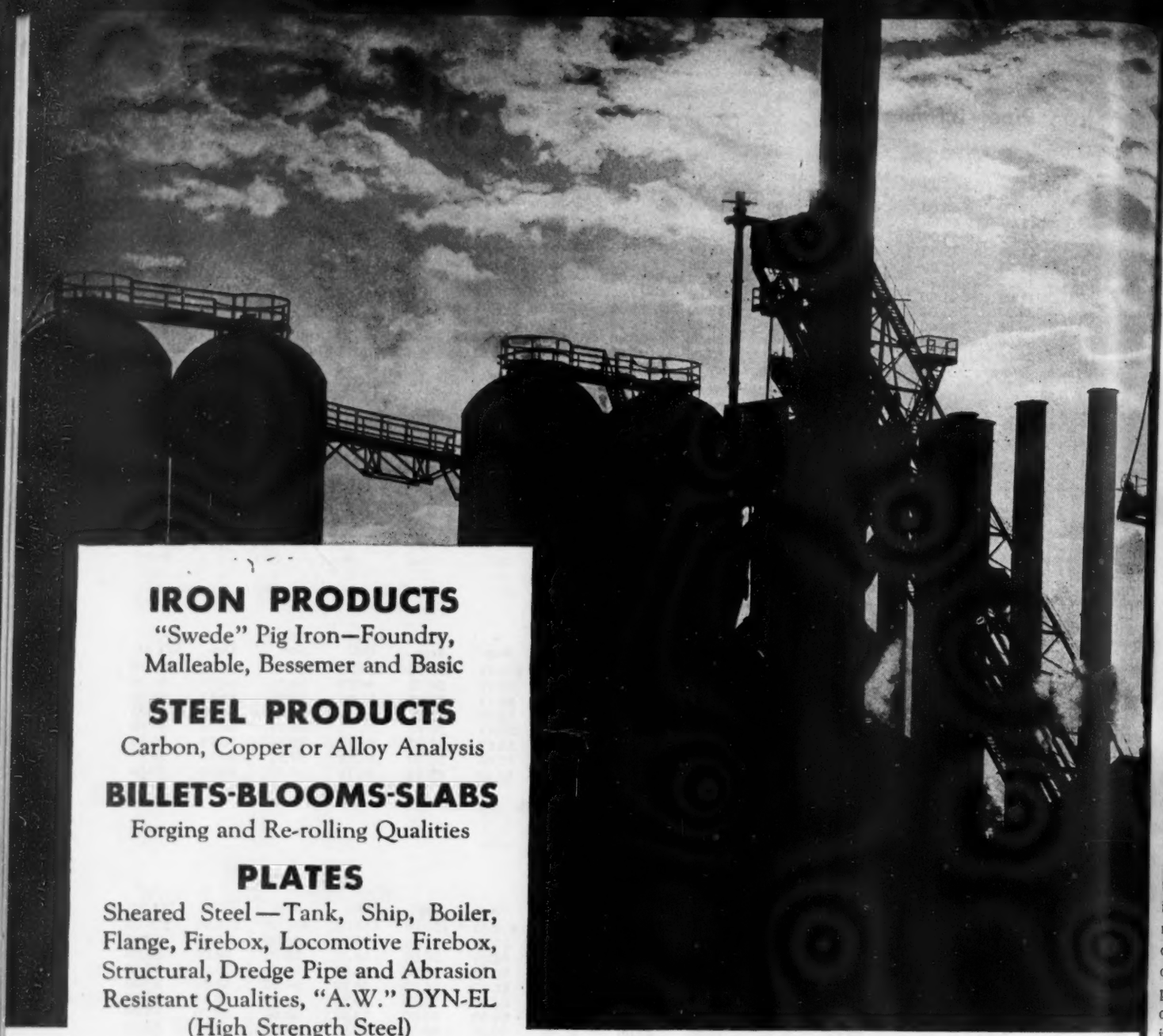
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yr's Av.
1944	$23.05	$23.05	$23.05	$23.05	$23.05	$23.05	$23.05	$23.05	$23.05	$23.05	$23.05	$23.05	$23.05
1943	23.05	23.05	23.05	23.05	23.05	23.05	23.05	23.05	23.05	23.05	23.05	23.05	23.05
1942	23.05	23.05	23.05	23.05	23.05	23.05	23.05	23.05	23.05	23.05	23.05	23.05	23.05
1941	22.80	22.95	23.05	23.05	23.05	23.05	23.05	23.05	23.05	23.05	23.05	23.05	23.05
1940	22.05	22.05	22.05	22.05	22.05	22.05	22.05	22.05	22.05	22.05	22.38	22.07
1939	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	21.05	22.05	22.05	20.66
1938	22.92	22.92	22.92	23.02	23.05	23.05	19.05	19.05	19.05	20.05	20.05	21.26
1937	19.96	19.98	22.10	22.84	22.84	22.84	22.84	22.84	22.84	22.84	22.90	22.81

Average of basic pig iron prices at Bethlehem, Birmingham, Buffalo, Chicago, Cleveland, Neville Island, Granite City and Youngstown.

Steelmaking Scrap Price Composite

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yr's Av.
1944	$19.17	$19.17	$19.17	$19.17	$19.17	$19.17	$19.17	$19.17	$18.00	$16.50	$16.40	$18.54	$18.95
1943	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17
1942	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17
1941	21.00	20.05	20.15	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.50
1940	17.60	17.10	16.55	16.19	17.30	19.15	18.65	18.80	20.20	20.70	20.80	21.40	18.70
1939	14.90	14.95	15.15	14.80	14.10	14.60	14.90	15.35	18.15	21.55	20.15	17.95	16.40
1938	14.10	13.70	13.40	12.60	11.60	11.10	13.30	14.55	14.35	14.15	14.70	14.90	13.55
1937	18.45	19.40	21.25	21.40	18.50	17.05	18.70	20.50	19.15	16.00	18.50	18.40	18.10

Average of No. 1 heavy melting steel scrap at Pittsburgh, Chicago and eastern Pennsylvania.



IRON PRODUCTS
"Swede" Pig Iron—Foundry, Malleable, Bessemer and Basic

STEEL PRODUCTS
Carbon, Copper or Alloy Analysis

BILLETS-BLOOMS-SLABS
Forging and Re-rolling Qualities

PLATES
Sheared Steel—Tank, Ship, Boiler, Flange, Firebox, Locomotive Firebox, Structural, Dredge Pipe and Abrasion Resistant Qualities, "A.W." DYN-EL (High Strength Steel)

SHEETS
Hot Rolled Sheets for every purpose "A.W." DYN-EL (High Strength Steel)

"A.W." ROLLED STEEL FLOOR PLATE
Super-Diamond, Standard Diamond, Diamondette, Sunken Diamond and Ribbed Pattern

READING BRAND "A.W." CUT NAILS
Black—Quenched and Tempered—Galvanized

"A.W." Quality PRODUCTS

To insure the *quality* of "A.W." Products, *controls* extend from our own mines, through all stages of manufacture, to the finished product. If you have a problem requiring either carbon or alloy steels, our Metallurgical Department is at your command.

ALAN WOOD STEEL COMPANY

MAIN OFFICE AND MILLS: CONSHOHOCKEN, PENNSYLVANIA : SINCE 1826. District Offices and Representatives: Philadelphia, New York, Boston, Atlanta, Buffalo, Chicago, Cincinnati, Cleveland, Denver, Detroit, Houston, St. Paul, New Orleans, Pittsburgh, Roanoke, Los Angeles, San Francisco, Seattle, Montreal.

Steel Mills Enter Year With Full Order Books

Price changes on some products impending. . . . Deliveries extended well toward midyear as war demand grows. . . . Scrap touches ceiling

STEELMAKERS enter the new year with order books crowded, war needs pressing for quick delivery and diversion of steel to civilian production on a larger scale indefinitely postponed. At the same time the industry is confronted with a wage increase which may necessitate upward revision in prices on certain steel products in the immediate future.

Substantial increase in steel wages was recommended by the War Labor Board late in November, but actual effecting of the award hinges upon approval by Director of Economic Stabilization Vinson, who is expected to be guided in his decision by the Office of Price Administration. Late last week it was understood OPA had advised the wage increase could be effected without necessitating any general steel price boost, though it was reported to have advised upward revision would be necessary on certain products. Steelmakers have stated for some time past they have been absorbing $3 to $5 per ton loss on a number of products and any wage increase will add to this burden.

Deliveries as the year opens are deferred much further than had been foreseen for this period, the expected decline in demand at the yearend failing to appear. Increased demand for munitions, for small arms as well as artillery, has caused considerable diversion of steel from other uses and requirements continue to increase month by month. Consumers placing orders press for delivery promises in order to seek other sources if their usual mill supplier cannot handle their inquiry.

To some extent lack of manpower is causing some consumers to lag in processing of the steel they receive and inventories show increase in some instances for this reason. It is reported that requests for deferred delivery may be received early this year as this condition continues.

Spot authorizations with Z-1 allotments for civilian goods are practically without value now as mills and warehouses are unable to consider anything other than Controlled Materials Plan allotments.

Among most deferred products is wire, need for which by the services is as heavy as at any time since the war started. Rope wire, in heavy use on ships carrying supplies to the war fronts, has filled mills to capacity for some months and no more orders can be taken for some time.

Bar deliveries have been extended rapidly and now first quarter tonnage on books is one of the heaviest loads encountered during the war. The heavy shell program and need for large artillery ammunition is added to needs for heavy truck parts and for aircraft. First quarter is practically sold out by most producers and impending programs promise to absorb full production to midyear.

Holiday observance caused the steelmaking rate to drop 3½ points to 92½ per cent of capacity, a usual thing for the holiday week. Pittsburgh declined 11 points to 79 per cent, Wheeling 5½ points to 91½, Youngstown 7 points to 83 and Cleveland 9½ points to 85 per cent. Buffalo regained 9½ points to 93 per cent and Cincinnati rose 10 points to 92 per cent. Rates were unchanged as follows: Chicago, 99½; New England, 87; St. Louis, 75; eastern Pennsylvania, 94; Birmingham, 95; Detroit, 88.

With the exception of borings and turnings and some minor grades, steelmaking scrap prices have returned to ceilings and the market is strong. In general mills are buying to support the high rate of steel production and replenish inventories allowed to run down in the fall. Cast grades continue scarce and supply is far short of needs.

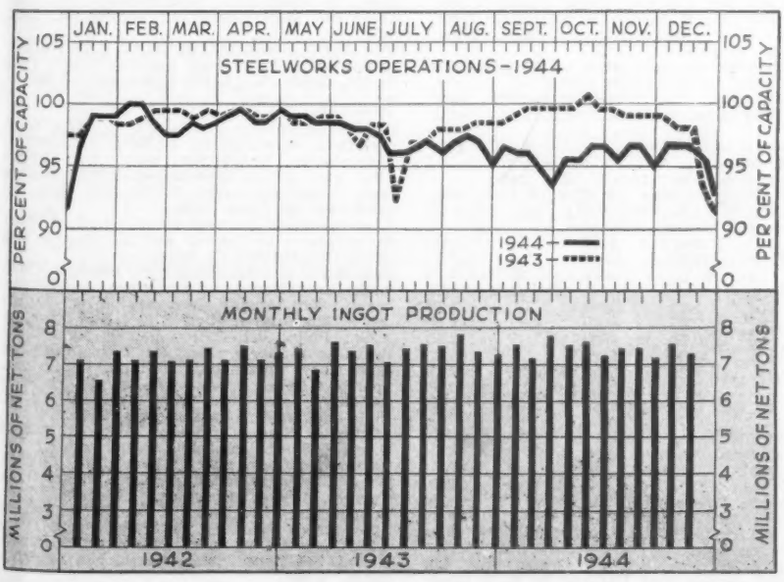
Average composite prices of iron and steel products continue at ceilings, finished steel at $56.73, semifinished steel at $36, steelmaking pig iron at $23.05 and steelmaking scrap at $19.17.

DISTRICT STEEL RATES

Percentage of Ingot Capacity Engaged in Leading Districts

	Week Ended Dec. 30	Change	Same Week 1943	Same Week 1942
Pittsburgh	79	—11	94	96
Chicago	99.5	None	96	102
Eastern Pa.	94	None	96	91
Youngstown	83	—7	75	97
Wheeling	91.5	—5.5	79	70
Cleveland	85	—9.5	60	92.5
Buffalo	93	+9.5	86	90.5
Birmingham	95	None	95	95
New England	87	None	95	100
Cincinnati	92	+10	77	88
St. Louis	75	None	85.5	93
Detroit	88	None	64	89
Average	92.5	—3.5	*91.5	*97.5

*Based on steelmaking capacities as of these dates.



COMPOSITE MARKET AVERAGES

	Dec. 30	Dec. 23	Dec. 16	One Month Ago June, 1944	Three Months Ago April, 1944	One Year Ago July, 1943	Five Years Ago July, 1939
Finished Steel	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73	$56.73
Semifinished Steel	36.00	36.00	36.00	36.00	36.00	36.00	36.15
Steelmaking Pig Iron	23.05	23.05	23.05	23.05	23.05	23.05	22.05
Steelmaking Scrap	19.17	19.17	19.17	16.40	19.17	19.17	17.95

Finished Steel Composite:—Average of industry-wide prices on sheets, strips, bars, plates, shapes, wire nails, tin plate, standard and line pipe. Semifinished Steel Composite:—Average of industry-wide prices on billets, slabs, sheet bars, skelp and wire rods. Steelmaking Pig Iron Composite:—Average of basic pig iron prices at Bethlehem, Birmingham, Buffalo, Chicago, Cleveland, Neville Island, Granite City and Youngstown. Steelworks Scrap Composite:—Average of No. 1 heavy melting steel prices at Pittsburgh, Chicago and eastern Pennsylvania. Finished steel, net tons; others, gross tons.

COMPARISON OF PRICES

Representative Market Figures for Current Week; Average for Last Month, Three Months and One Year Ago

Finished Material

	Dec. 30, 1944	Nov., 1944	Sept., 1944	Dec., 1943
Steel bars, Pittsburgh	2.15c	2.15c	2.15c	2.15c
Steel bars, Chicago	2.15	2.15	2.15	2.15
Steel bars, Philadelphia	2.47	2.47	2.47	2.47
Shapes, Pittsburgh	2.10	2.10	2.10	2.10
Shapes, Philadelphia	2.215	2.215	2.215	2.215
Shapes, Chicago	2.10	2.10	2.10	2.10
Plates, Pittsburgh	2.10	2.10	2.10	2.10
Plates, Philadelphia	2.15	2.15	2.15	2.15
Plates, Chicago	2.10	2.10	2.10	2.10
Sheets, hot-rolled, Pittsburgh	2.10	2.10	2.10	2.10
Sheets, cold-rolled, Pittsburgh	3.05	3.05	3.05	3.05
Sheets, No. 24 galv., Pittsburgh	3.50	3.50	3.50	3.50
Sheets, hot-rolled, Gary	2.10	2.10	2.10	2.10
Sheets, cold-rolled, Gary	3.05	3.05	3.05	3.05
Sheets, No. 24 galv., Gary	3.50	3.50	3.50	3.50
Bright bess., basic wire, Pittsburgh	2.60	2.60	2.60	2.60
Tin plate, per base box, Pittsburgh	$5.00	$5.00	$5.00	$5.00
Wire nails, Pittsburgh	2.55	2.55	2.55	2.55

Semifinished Material

Sheet bars, Pittsburgh, Chicago	$34.00	$34.00	$34.00	$34.00
Slabs, Pittsburgh, Chicago	34.00	34.00	34.00	34.00
Rerolling billets, Pittsburgh	34.00	34.00	34.00	34.00
Wire rods, No. 5 to ⅜-inch, Pitts.	2.00	2.00	2.00	2.00

Pig Iron

	Dec. 30, 1944	Nov., 1944	Sept., 1944	Dec., 1943
Bessemer, del. Pittsburgh	$25.19	$25.19	$25.19	$25.19
Basic, Valley	23.50	23.50	23.50	23.50
Basic, eastern del. Philadelphia	25.34	25.34	25.34	25.34
No. 2 fdry., del. Pitts., N.&S. Sides	24.69	24.69	24.69	24.69
No. 2 foundry, Chicago	24.00	24.00	24.00	24.00
Southern No. 2, Birmingham	20.38	20.38	20.38	20.38
Southern No. 2 del. Cincinnati	24.30	24.30	24.30	24.30
No. 2 fdry., del. Phila.	25.84	25.84	25.84	25.84
Malleable, Valley	24.00	24.00	24.00	24.00
Malleable, Chicago	24.00	24.00	24.00	24.00
Lake Sup., charcoal, del. Chicago	37.34	37.34	37.34	37.34
Gray forge, del. Pittsburgh	24.19	24.19	24.19	24.19
Ferromanganese, del. Pittsburgh	140.33	140.33	140.33	140.33

Scrap

Heavy melting steel, No. 1 Pittsburgh	$20.00	$17.15	$19.00	$20.00
Heavy melt. steel, No. 2, E. Pa.	17.00	16.05	18.75	18.75
Heavy melting steel, Chicago	18.75	16.70	18.75	18.75
Rails for rolling, Chicago	22.25	22.25	22.25	22.25
No. 1 cast, Chicago	20.00	20.00	20.00	20.00

Coke

Connellsville, furnace, ovens	$7.00	$7.00	$7.00	$6.50
Connellsville, foundry ovens	7.75	7.75	7.75	7.75
Chicago, by-product fdry., del.	13.35	13.35	13.35	13.20

STEEL, IRON RAW MATERIAL, FUEL AND METALS PRICES

Following are maximum prices established by OPA Schedule No. 6 issued April 16, 1941, revised June 20, 1941 and Feb. 4, 1942. The schedule covers all iron or steel ingots, all semifinished iron or steel products, all finished hot-rolled, cold-rolled iron or steel products and any iron or steel product which is further finished by galvanizing, plating, coating, drawing, extruding, etc., although only principal established basing points for selected products are named specifically. Seconds and off-grade products are also covered. Exceptions applying to individual companies are noted in the table.

Semifinished Steel

Gross ton basis except wire rods, skelp.

Carbon Steel Ingots: F.o.b. mill base, rerolling qual., stand. analysis, $31.00.
(Empire Sheet & Tin Plate Co., Mansfield, O., may quote carbon steel ingots at $33 gross ton, f.o.b. mill. Kaiser Co. Inc. $43, f.o.b. Pacific ports.)

Alloy Steel Ingots: Pittsburgh, Chicago, Buffalo, Bethlehem, Canton, Massillon; uncrop., $45.

Rerolling Billets, Blooms, Slabs: Pittsburgh, Chicago, Gary, Cleveland, Buffalo, Sparrows Point, Birmingham, Youngstown, $34; Detroit, del. $36; Duluth (bil) $36; Pac. Ports, (bil) $46. (Andrews Steel Co., carbon slabs $41; Continental Steel Corp., billets $34, Kokomo, to Acme Steel Co.; Northwestern Steel & Wire Co., $41, Sterling, Ill.; Laclede Steel Co. $34, Alton or Madison, Ill.; Wheeling Steel Corp. $36 base, billets for lend-lease, $34, Portsmouth, O., on slabs on WPB directives. Granite City Steel Co. $47.50 gross ton slabs from D.P.C. mill. Geneva Steel Co., Kaiser Co. Inc., $58.64, Pac. Ports).

Forging Quality Blooms, Slabs, Billets: Pittsburgh, Chicago, Gary, Cleveland, Buffalo, Birmingham, Youngstown, $40. Detroit, del. $42; Duluth, billets, $42; forg. bil. f.o.b. Pac. Ports, $52.
(Andrews Steel Co. may quote carbon forging billets $50 gross ton at established basing points; Follansbee Steel Corp., $49.50 f.o.b. Toronto, O. Geneva Steel Co., Kaiser Co. Inc., $64.64, Pacific ports.)

Open Hearth Shell Steel: Pittsburgh, Chicago, Gary, Cleveland, Buffalo, Youngstown, Birmingham, base 1000 tons one size and section; 3-12 in., $52; 12-18 in., excel., $54.00; 18 in. and over $56. Add $2.00 del. Detroit; $3.00 del. Eastern Mich. (Kaiser Co. Inc., $76.64, f.o.b. Los Angeles.)

Alloy Billets, Slabs, Blooms: Pittsburgh, Chicago, Buffalo, Bethlehem, Canton, Massillon, $54; del. Detroit $56, Eastern Mich. $57.

Sheet Bars: Pittsburgh, Chicago, Cleveland, Buffalo, Canton, Sparrows Point, Youngstown, $34. (Wheeling Steel Corp. $37 on lend-lease sheet bars. $38 Portsmouth, O., on WPB directives; Empire Sheet & Tin Plate Co., Mansfield, O., carbon sheet bars, $39, f.o.b. mill.)

Skelp: Pittsburgh, Chicago, Sparrows Point, Youngstown, Coatesville, lb., 1.90c.

Wire Rods: Pittsburgh, Chicago, Cleveland, Birmingham, No. 5—$\frac{3}{8}$ in. inclusive, per 100 lbs., $2. Do., over $\frac{3}{8}$—$\frac{47}{64}$-in., incl., $2.15; Galveston, base, 2.25c and 2.40c, respectively. Worcester add $0.10; Pacific Ports $0.50. (Pittsburgh Steel Co., $0.20 higher.)

Bars

Hot-Rolled Carbon Bars and Bar-Size Shapes under 3": Pittsburgh, Chicago, Gary, Cleveland, Buffalo, Birmingham, base 20 tons one size, 2.15c; Duluth, base 2.25c; Mahoning Valley 2.22½c; Detroit, del. 2.25c; Eastern Mich. 2.30c; New York del. 2.49c; Phila. del. 2.47c; Gulf Ports, dock 2.52c; Pac. ports, dock 2.80c. (Calumet Steel Division, Borg Warner Corp., and Joslyn Mfg. & Supply Co. may quote 2.35c, Chicago base; Sheffield Steel Corp., 2.75c, f.o.b. St. Louis.)

Rail Steel Bars: Same prices as for hot-rolled carbon bars except base is 5 tons.
(Sweet's Steel Co., Williamsport, Pa., may quote rail steel merchant bars 2.33c f.o.b. mill.)

Hot-Rolled Alloy Bars: Pittsburgh, Chicago, Canton, Massillon, Buffalo, Bethlehem. base 20 tons one size, 2.70c; Detroit, del., 2.80c.
(Texas Steel Co. may use Chicago base price as maximum f.o.b. Fort Worth, Tex., price on sales outside Texas, Oklahoma.)

AISI Series	(*Basic O-H)	AISI Series	(*Basic O-H)
1300	$0.10	4100 (.15-.25 Mo)	0.70
		(.20-.30 Mo)	0.75
2300	1.70	4300	1.70
2500	2.55	4600	1.20
3000	0.50	4800	2.15
3100	0.85	5100	0.35
3200	1.35	5130 or 5152	0.45
3400	3.20	6120 or 6152	0.95
4000	0.45-0.55	6145 or 6150	1.20

*Add 0.25 for acid open-hearth; 0.50 electric.

Cold-Finished Carbon Bars: Pittsburgh, Chicago, Gary, Cleveland, Buffalo, base 20,000-39,999 lbs., 2.65c; Detroit 2.70c; Toledo 2.80c. (Keystone Drawn Steel Co. may sell outside its usual market area on Proc. Div., Treasury Dept. contracts at 2.65c, Spring City, Pa., plus freight on hot-rolled bars from Pittsburgh to Spring City. New England Drawn Steel Co. may sell outside New England on WPB directives at 2.65c, Mansfield, Mass., plus freight on hot-rolled bars from Buffalo to Mansfield.)

Cold-Finished Alloy Bars: Pittsburgh, Chicago, Gary, Cleveland, Buffalo, base 3.35c; Detroit, del. 3.45c; Eastern Mich. 3.50c.

Reinforcing Bars (New Billet): Pittsburgh, Chicago, Gary, Cleveland, Birmingham, Sparrows Point, Buffalo, Youngstown, base 2.15c; Detroit del. 2.25c; Eastern Mich. and Toledo 2.30c; Gulf ports, dock 2.50c; Pacific ports, dock 2.55c.

Reinforcing Bars (Rail Steel): Pittsburgh, Chicago, Gary, Cleveland, Birmingham, Youngstown, Buffalo base 2.15c; Detroit, del. 2.25c; Eastern Mich. and Toledo 2.30c; Gulf ports, dock 2.50c.
(Sweet's Steel Co., Williamsport, Pa., may quote rail steel reinforcing bars 2.33c, f.o.b. mill.)

Iron Bars: Single refined, Pitts. 4.40c; double refined 5.40c; Pittsburgh, staybolt, 5.75c; Terre Haute, single ref., 5.00c, double ref., 6.25c.

Sheets, Strip

Hot-Rolled Sheets: Pittsburgh, Chicago, Gary, Cleveland, Birmingham, Buffalo, Youngstown, Sparrows Pt., Middletown, base 2.10c; Granite City, base 2.20c; Detroit del. 2.20c; Eastern Mich. 2.25c; Phila. del. 2.27c; New York del. 2.34c; Pacific ports 2.65c.
(Andrews Steel Co. may quote hot-rolled sheets for shipment to Detroit and the Detroit area on the Middletown, O. base.)

Cold-Rolled Sheets: Pittsburgh, Chicago, Cleveland, Gary, Buffalo, Youngstown, Middletown, base, 3.05c; Granite City, base 3.15c; Detroit del. 3.15c; Eastern Mich. 3.20c; New York del. 3.39c; Phila. del. 3.37c; Pacific ports 3.70c.

Galvanized Sheets, No. 24: Pittsburgh, Chicago, Gary, Birmingham, Buffalo, Youngstown, Sparrows Point, Middletown, base 3.50c; Granite City, base 3.60c; New York del. 3.74c; Phila. del. 3.67c; Pacific ports 4.05c.
(Andrews Steel Co. may quote galvanized sheets 3.75c at established basing points.)

Corrugated Galv. Sheets: Pittsburgh, Chicago, Gary, Birmingham, 29 gage, per square 3.31c.

Culvert Sheets: Pittsburgh, Chicago, Gary, Birmingham, 16 gage, not corrugated, copper alloy 3.60c; Granite City 3.70c; Pacific Ports 4.25c; copper iron 3.90c, pure iron 3.95c; zinc-coated, hot-dipped, heat-treated, No. 24, Pittsburgh, 4.25c.

Enameling Sheets: 10-gage; Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Middletown, base, 2.75c; Granite City, base 2.85c; Detroit, del. 2.85c; eastern, Mich. 2.90c; Pacific ports 3.40c; **20-gage;** Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Middletown, base 3.35c; Detroit del. 3.45c; eastern Mich. 3.50c; Pacific ports 4.00c.

Electrical Sheets No. 24:

	Pittsburgh Base	Pacific Ports	Granite City
Field grade	3.20c	3.95c	3.30c
Armature	3.55c	4.30c	3.65c
Electrical	4.05c	4.80c	4.15c
Motor	4.95c	5.70c	5.05c
Dynamo	5.65c	6.40c	5.75c
Transformer			
72	6.15c	6.90c	.....
65	7.15c	7.90c	.....
58	7.65c	8.40c	.....
52	8.45c	9.20c	.....

Hot-Rolled Strip: Pittsburgh, Chicago, Gary, Cleveland, Birmingham, Youngstown, Middletown, base 1 ton and over, 12 inches wide and less 2.10c; Detroit del. 2.20c; Eastern Mich. 2.25c; Pacific ports 2.75c. (Joslyn Mfg. Co. may quote 2.30c, Chicago base.)

Cold Rolled Strip: Pittsburgh, Cleveland, Youngstown, 0.25 carbon and less 2.80c; Chicago, base 2.90c; Detroit, del. 2.90c; Eastern Mich. 2.95c; Worcester base 3.00c.

Commodity C. R. Strip: Pittsburgh, Cleveland, Youngstown, base 3 tons and over, 2.95c; Chicago 3.05c; Detroit del. 3.05c; Eastern Mich. 3.10c; Worcester base 3.35c.

Cold-Finished Spring Steel: Pittsburgh, Cleveland bases, add 20c for Worcester; .26-.50 Carb., 2.80c; .51-.75 Carb., 4.30c; .76-1.00 Carb., 6.15c; over 1.00 Carb., 8.35c.

Tin, Terne Plate

Tin Plate: Pittsburgh, Chicago, Gary, 100-lb. base box, $5.00; Granite City $5.10.

Electrolytic Tin Plate: Pittsburgh, Gary, 100-lb. base box, 0.50 lb. tin, $4.50; 0.75 lb. tin $4.65.

Tin Mill Black Plate: Pittsburgh, Chicago, Gary, base 29 gage and lighter, 3.05c; Granite City, 3.15c; Pacific ports, boxed 4.05c.

Long Ternes: Pittsburgh, Chicago, Gary, No. 24 unassorted 3.80c; Pacific ports 4.55c.

Manufacturing Ternes: (Special Coated) Pittsburgh, Chicago, Gary, 100-base box $4.30; Granite City $4.40.

Roofing Ternes: Pittsburgh base per package 112 sheets; 20 x 28 in., coating I.C. 8-lb. $12.00; 15-lb. $14.00; 20-lb. $15.00; 25-lb. $16; 30-lb. $17.25; 40-lb. $19.50.

Plates

Carbon Steel Plates: Pittsburgh, Chicago, Gary, Cleveland, Birmingham, Youngstown, Sparrows Point, Coatesville, Claymont, 2.10c; New York, del. 2.29c; Phila., del. 2.15c; St. Louis, 2.34c; Boston, del. 2.42-67c; Pacific ports, 2.65c; Gulf Ports, 2.45c.
(Granite City Steel Co. may quote carbon plates 2.35c f.o.b. mill; 2.65c f.o.b. D.P.C. mill; Kaiser Co. Inc., 3.20c, f.o.b. Los Angeles. Central Iron & Steel Co. 2.50c f.o.b. basing points; Geneva Steel Co., Provo, Utah, 3.20c, f.o.b. Pac. ports.)

Floor Plates: Pittsburgh, Chicago, 3.35c; Pacific ports, 4.00c.

Open-Hearth Alloy Plates: Pittsburgh, Chicago, Coatesville, 3.50c; Gulf ports 3.95c; Pacific ports 4.15c.

Wrought Iron Plates: Pittsburgh, 3.80c.

Shapes

Structural Shapes: Pittsburgh, Chicago, Gary, Birmingham, Buffalo, Bethlehem, 2.10c; New York, del. 2.27c; Phila., del. 2.215c; Pacific ports, 2.75c.
(Phoenix Iron Co., Phoenixville, Pa., may quote carbon steel shapes at 2.35c at established basing points and 2.50c, Phoenixville, for export; Sheffield Steel Corp., 2.55c f.o.b. St. Louis. Geneva Steel Co., 3.25c, Pac. ports); Kaiser Co. Inc., 3.20c f.o.b. Los Angeles.)

Steel Sheet Piling: Pittsburgh, Chicago, Buffalo, 2.40c.

Wire Products, Nails

Wire: Pittsburgh, Chicago, Cleveland, Birmingham (except spring wire) to manufacturers in carloads (add $2 for Worcester, $1 for Duluth).

Bright basic, bessemer wire 2.60c
Spring wire 3.20c
(Pittsburgh Steel Co., 0.20c higher.)

Wire Products to the Trade:
Standard and Cement-coated wire nails, and staples, 100-lb. keg, Pittsburgh, Chicago, Birmingham, Cleveland, Duluth $2.55; Pacific ports 3.05c
Annealed fence wire, 100-lb., Pittsburgh, Chicago, Cleveland 3.05c
Galvanized fence wire, 100 lb., Pittsburgh, Chicago, Cleveland 3.40c
Woven fence, 15½ gage and heavier, per base column ..... .67c
Barbed wire, 80-rod spool, Pittsburgh, Chicago, Cleveland, Birmingham, column 70; twisted barbless wire, column 70.

Tubular Goods

Welded Pipe: Base price in carloads, threaded and coupled to consumers about $200 per net ton. Base discounts on steel pipe Pittsburgh and Lorain, O.; Gary, Ind. 2 points less on lap weld, 1 point less on butt weld. Pittsburgh base only on wrought iron pipe.

Butt Weld

In.	Steel Blk.	Steel Galv.	In.	Iron Blk.	Iron Galv.
⅛	56	33	⅛	24	3½
¼ & ⅜	59	40½	¼	30	10
½	63½	51	1-1¼	34	16
¾	66½	55	1½	38	18½
1-3	68½	57½	2	37½	18

Lap Weld

In.	Steel Blk.	Steel Galv.	In.	Iron Blk.	Iron Galv.
2	61	49½	1¼	23	3½
2½-3	64	52½	1½	28½	10
3½-6	66	54½	2	30½	12
7-8	65	52½	2½, 3½	31½	14½
9-19	64½	52	4	33½	18
11-12	63½	51	4½-8	32½	17
			9-12	28½	12

Boiler Tubes: Net base prices per 100 feet f.o.b. Pittsburgh in carload lots, minimum wall, cut lengths 4 to 24 feet, inclusive.

O.D. Sizes	B.W.G.	—Seamless— Hot Rolled	Cold Drawn	—Lap Weld— Steel	Charcoal Iron
1"	13	$ 7.82	$ 9.01	.....	.....
1¼"	13	9.26	10.67	.....	.....
1½"	13	10.23	11.72	$ 9.72	$23.71
1¾"	13	11.64	13.42	11.06	22.93
2"	13	13.04	15.03	12.38	19.35
2¼"	13	14.54	16.76	13.79	21.63
2¼"	12	16.01	18.45	15.16	.....
2½"	12	17.54	20.21	16.58	26.57
2¾"	12	18.59	21.42	17.54	29.00
3"	12	19.50	22.48	18.35	31.38
3½"	11	24.63	28.37	23.15	39.81
4"	10	30.54	35.20	28.66	49.90
4½"	10	37.35	43.04	35.22	.....
5"	9	46.87	54.01	44.25	73.93
6"	7	71.96	82.93	68.14	....

Rails, Supplies

Standard rails, over 60-lb., f.o.b. mill, gross ton, $40.00. Light rails (billet), Pittsburgh, Chicago, Birmingham, gross ton, $40.00.
•Relaying rails, 35 lbs. and over, f.o.b. railroad and basing points, $28-$30.
Supplies: Track bolts, 4.75c; heat treated, 5.00c. Tie plates, $43 net ton, base, Standard spikes, 3.00c.

•Fixed by OPA Schedule No. 46, Dec. 15, 1941.

Tool Steels

Tool Steels: Pittsburgh, Bethlehem, Syracuse, base, cents per lb.; Reg. carbon 14.00c; extra carbon 18.00c; special carbon 22.00c; oil-hardening 24.00c; high car.-chr. 43.00c.

Tung	Chr.	Van.	Moly.	Pitts. base per lb.
18.00	4	1	...	67.00c
1.5	4	1	8.5	54.00c
....	4	2	8	54.00c
5.50	4	1.50	4	57.50c
5.50	4.50	4	4.50	70.00c

Stainless Steels

Base, Cents per lb.—f.o.b. Pittsburgh

Type	Bars	Plates	Sheets	H. R. Strip	C. R Strip
CHROMIUM NICKEL STEEL					
302	24.00c	27.00c	34.00c	21.50c	28.00c
303	26.00	29.00	36.00	27.00	33.00
304	25.00	29.00	36.00	23.50	30.00
308	29.00	34.00	41.00	28.50	35.00
309	36.00	40.00	47.00	37.00	47.00
310	49.00	52.00	53.00	48.75	56.00
312	36.00	40.00	49.00	.....	....
•316	40.00	44.00	48.00	40.00	45.00
†321	29.00	34.00	41.00	29.25	38.00
‡347	33.00	38.00	45.00	33.00	42.00
431	19.00	22.00	29.00	17.50	22.50
STRAIGHT CHROMIUM STEEL					
403	21.50	24.50	29.50	21.25	27.00
••410	18.50	21.50	26.50	17.00	22.00
416	19.00	22.00	27.00	18.25	23.50
††420	24.00	28.50	33.50	23.75	36.50
430	19.00	22.00	29.00	17.50	22.50
‡‡430F	19.50	22.50	29.50	18.75	24.50
440A	24.00	28.50	33.50	23.75	36.50
442	22.50	25.50	32.50	24.00	32.00
443	22.50	25.50	32.50	24.00	32.00
446	27.50	30.50	36.50	35.00	52.00
501	8.00	12.00	15.75	12.00	17.00
502	9.00	13.00	16.75	13.00	18.00
STAINLESS CLAD STEEL (20%)					
304	.....	§§18.00	19.00	.....	.....

•With 2-3% moly. †With titanium. ‡With columbium. ••Plus machining agent. ††High carbon. ‡‡Free machining. §§Includes annealing and pickling.

Basing Point Prices are (1) those announced by U. S. Steel Corp. subsidiaries for first quarter of 1941 or in effect April 16, 1941 at designated basing points or (2) those prices announced or customarily quoted by other producers at the same designated points. Base prices under (2) cannot exceed those under (1) except to the extent prevailing in third quarter of 1940.

Extras mean additions or deductions from base prices in effect April 16, 1941.

Delivered prices applying to Detroit, Eastern Michigan, Gulf and Pacific Coast points are deemed basing points except in the case of the latter two areas when water transportation is not available, in which case nearest basing point price, plus all-rail freight may be charged.

Domestic Ceiling prices are the aggregate of (1) governing basing point price, (2) extras and (3) transportation charges to the point of delivery as customarily computed. **Governing basing point** is basing point nearest the consumer providing the lowest delivered price.

Seconds, maximum prices: flat-rolled rejects 75% of prime prices, wasters 75%, waste-wasters 65% except plates, which take waster prices; tin plate $2.80 per 100 lbs.; terne plate $2.25; semifinished 85% of primes; other grades limited to new material ceilings.

Export ceiling prices may be either the aggregate of (1) governing basing point or emergency basing point (2) export extras (3) export transportation charges provided they are the f.a.s. seaboard quotations of the U. S. Steel Export Co. on April 16, 1941.

Bolts, Nuts

F.o.b. Pittsburgh, Cleveland, Birmingham, Chicago. Discounts for carloads additional 5%, full containers, add 10%

Carriage and Machine

½ x 6 and smaller ..... 65½ off
Do., ⅝ and ⅝ x 6-in. and shorter ... 63½ off
Do., ¾ to 1 x 6-in. and shorter ..... 61 off
1⅛ and larger, all lengths ..... 59 off
All diameters, over 6-in. long ..... 59 off
Tire bolts ..... 50 off
Step bolts ..... 56 off
Plow bolts ..... 65 off

Stove Bolts

In packages with nuts separate 71-10 off; with nuts attached 71 off; bulk 80 off on 15,000 of 3-inch and shorter, or 5000 over 3-in.

Nuts

Semifinished hex	U.S.S.	S.A.E.
⅞-inch and less	62	64
⅛-1-inch	59	60
1⅛-1½-inch	57	58
1⅝ and larger	56	

Hexagon Cap Screws

Upset 1-in., smaller ..... 64 off
Milled 1-in., smaller ..... 60 off

Square Head Set Screws

Upset, 1-in., smaller ..... 71 off
Headless, ¼-in., larger ..... 60 off
No. 10, smaller ..... 70 off

Piling

Pittsburgh, Chicago, Buffalo 2.40c

Rivets, Washers

F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham

Structural 3.75c
⅞-inch and under ..... 65-5 off
Wrought Washers, Pittsburgh, Chicago, Philadelphia, to jobbers and large nut, bolt manufacturers l.c.l. ... $2.75-3.00 off

Metallurgical Coke

Price Per Net Ton

Beehive Ovens

Connellsville, furnace ..... •7.00
Connellsville, foundry 7.50- 8.00
Connellsville, prem. fdry. 7.75- 8.10
New River, foundry 8.50- 8.75
Wise county, foundry 7.25- 7.75

By-Product Foundry

Wise county, furnace 6.75- 7.25
Kearney, N. J., ovens 12.65
Chicago, outside delivered 12.60
Chicago, delivered 13.35
Terre Haute, delivered 13.10
Milwaukee, ovens 13.35
New England, delivered 14.25
St. Louis, delivered ..... †13.35
Birmingham, delivered 10.50
Indianapolis, delivered 13.10
Cincinnati, delivered 12.85
Cleveland, delivered 12.80
Buffalo, delivered 13.00
Detroit, delivered 13.35
Philadelphia, delivered 12.88

•Operators of hand-drawn ovens using trucked coal may charge $7.75, effective Nov. 29, 1943.
†13.85 from other than Ala., Mo., Tenn.

Coke By-Products

Spot, gal., freight allowed east of Omaha

Pure and 90% benzol 15.00c
Toluol, two degree 28.00c
Solvent naphtha 27.00c
Industrial xylol 27.00c

Per lb. f.o.b. works

Phenol (car lots, returnable drums) 12.50c
Do., less than car lots 13.25c
Do., tank cars 11.50c

Eastern Plants, per lb.

Naphthalene flakes, balls, bbls., to jobbers 8.00c

Per ton, bulk, f.o.b. port

Sulphate of ammonia $29.20

Pig Iron

Prices (in gross tons) are maximums fixed by OPA Price Schedule No. 10, effective June 10, 1941. Exceptions indicated in footnotes. Allocation regulations from WPB Order M-17, expiring Dec. 31, 1942. Base prices **bold face, delivered light face. Federal tax on freight charges, effective** Dec. 1, 1942, not included in following prices.

	Foundry	Basic	Bessemer	Malleable
Bethlehem, Pa., base	$25.00	$24.50	$26.00	$25.50
Newark, N. J., del.	26.53	26.03	27.53	27.03
Brooklyn, N. Y., del.	27.50	.....	.....	28.00
Birdsboro, Pa., base	25.00	24.50	26.00	25.50
Birmingham, base	†20.38	†19.00	25.00	.....
Baltimore, del.	25.61	.....	.....	.....
Boston, del.	25.12	.....	.....	.....
Chicago, del.	24.22	.....	.....	.....
Cincinnati, del.	24.06	22.68	.....	.....
Cleveland, del.	24.12	23.24	.....	.....
Newark, N. J., del.	26.15	.....	.....	.....
Philadelphia, del.	25.46	24.58	.....	.....
St. Louis, del.	24.12	23.24	.....	.....
Buffalo, base	24.00	23.00	25.00	24.50
Boston, del.	25.50	25.00	26.50	26.00
Rochester, del.	25.53	.....	26.53	26.03
Syracuse, del.	26.08	.....	27.08	26.58
Chicago, base	24.00	23.50	24.50	24.00
Milwaukee, del.	25.10	24.60	25.60	25.10
Muskegon, Mich., del.	27.19	.....	.....	27.19
Cleveland, base	24.00	23.50	24.50	24.00
Akron, Canton, O., del.	25.39	24.89	25.89	25.39
Detroit, base	24.00	23.50	24.50	24.00
Saginaw, Mich., del	26.31	25.81	26.81	26.31
Duluth, base	24.50	24.00	25.00	24.50
St. Paul, del.	26.63	26.13	27.13	26.63
Erie, Pa., base	24.00	23.50	25.00	24.50
Everett, Mass., base	25.00	24.50	26.00	25.50
Boston, del.	25.50	25.00	26.50	26.00
Granite City, Ill., base	24.00	23.50	24.50	24.00
St. Louis, del.	24.50	24.00	.....	24.50
Hamilton, O., base	24.00	23.50	.....	24.00
Cincinnati, del.	24.44	24.61	.....	25.11
Neville Island, Pa., base	24.00	23.50	24.50	24.00
‡Pittsburgh, del. No. & So. sides	24.69	24.19	25.19	24.69
Provo, Utah, base	22.00	21.50	.....	.....
Sharpsville, Pa., base	24.00	23.50	24.50	24.00
Sparrows Point, base	25.00	24.50	.....	.....
Baltimore, del.	25.99	.....	.....	.....
Steelton, Pa., base	.....	24.50	.....	25.50
Swedeland, Pa., base	25.00	24.50	26.00	25.50
Philadelphia, del.	25.84	25.34	.....	26.34
Toledo, O., base	24.00	23.50	24.50	24.00
Youngstown, O., base	24.00	23.50	24.50	24.00
Mansfield, O., del.	25.94	25.44	25.44	25.94

Base grade, silicon 1.75-2.25%; add 50 cents for each additional 0.25% silicon, or portion thereof; deduct 50 cents for silicon below 1.75% on foundry iron. †For phosphorus 0.70% or over deduct 38 cents. ‡For McKees Rocks, Pa., add .55 to Neville Island base; Lawrenceville, Homestead, McKeesport, Ambridge, Monaca, Aliquippa, .84; Monessen, Monongahela City .97 (water); Oakmont, Verona 1.11; Brackenridge 1.24.

Note: Add 50 cents per ton for each 0.50% manganese or portion thereof over 1.00%.

Nickel differentials: Under 0.50%, no extra; 0.50% to 0.74% incl., $2 per ton; for each additional 0.25% nickel, $1 per ton.

High Silicon, Silvery

5.00-6.50 per cent (base)	$29.50		
6.51-7.00	$30.50	9.01- 9.50	$35.50
7.01-7.50	31.50	9.51-10.00	36.50
7.51-8.00	32.50	10.01-10.50	37.50
8.01-8.50	33.50	10.51-11.00	38.50
8.51-9.00	34.50	11.01-11.50	39.50

F.o.b. Jackson county, O., per gross ton, Buffalo base prices are $1.25 higher. Prices subject to additional charge of 50 cents a ton for each 0.50% manganese in excess of 1.00%.

Bessemer Ferrosilicon

Prices same as for high silicon silvery iron, plus $1 per gross ton. (For higher silicon irons a differential over and above the price of base grades is charged as well as for the hard chilling iron, Nos. 5 and 6.)

Charcoal Pig Iron

Northern

Lake Superior Furn.	$34.00
Chicago, del.	37.34

Southern

Semi-cold blast, high phos., f.o.b. furnace, Lyles, Tenn.	$28.50
Semi-cold blast, low phos., f.o.b. furnace, Lyles, Tenn.	33.00

Gray Forge

Neville Island, Pa.	$23.50
Valley base	23.50

Low Phosphorus

Basing points: Birdsboro, Pa., $29.50; Steelton, Pa., and Buffalo, N. Y., $29.50 base; $30.74, del., Philadelphia. Intermediate phos., Central Furnace, Cleveland, $26.50.

Switching Charges: Basing point prices are subject to an additional charge for delivery within the switching limits of the respective districts.

Silicon Differentials: Basing point prices are subject to an additional charge not to exceed 50 cents a ton for each 0.25 silicon in excess of base grade (1.75 to 2.25%).

Phosphorus Differential: Basing point prices are subject to a reduction of 38 cents a ton for phosphorus content of 0.70% and over.

Manganese Differentials: Basing point prices subject to an additional charge not to exceed 50 cents a ton for each 0.50% manganese content in excess of 1.0%.

Ceiling Prices are the aggregate of (1) governing basing point (2) differentials (3) transportation charges from governing basing point to point of delivery as customarily computed. Governing basing point is the one resulting in the lowest delivered price for the consumer.

Exceptions to Ceiling Prices: Pittsburgh Coke & Iron Co., (Sharpsville, Pa. furnace only) and Struthers Iron & Steel Co. may charge 50 cents a ton in excess of basing point prices for No. 2 Foundry, Basic Bessemer and Malleable. Mystic Iron Works, Everett, Mass., may exceed basing point prices by $2 per ton, effective May 20, 1943. Chester, Pa., furnace of Pittsburgh Coke & Iron Co. may exceed basing point prices by $2.25 per ton, effective July 27, 1942. E. & G. Brooke Co., Birdsboro, Pa., allowed $1 above basing point.

Refractories

Per 1000 f.o.b. Works, Net Prices

Fire Clay Brick

Super Quality

Pa., Mo., Ky.	$64.00

First Quality

Pa., Ill., Md., Mo., Ky.	51.30
Alabama, Georgia	51.30
New Jersey	56.00
Ohio	43.00

Second Quality

Pa., Ill., Md., Mo., Ky.	46.50
Alabama, Georgia	38.00
New Jersey	49.00
Ohio	36.00

Malleable Bung Brick

All bases	$59.80

Silica Brick

Pennsylvania	$51.30
Joliet, E. Chicago	53.90
Birmingham, Ala.	51.30

Ladle Brick

(Pa., O., W. Va., Mo.)

Dry press	$31.00
Wire cut	29.00

Magnesite

Domestic dead-burned grains, net ton f.o.b. Chewelah, Wash., net ton, bulk	22.00
net ton, bags	26.00

Basic Brick

Net ton, f.o.b. Baltimore, Plymouth Meeting, Chester, Pa.

Chrome brick	$54.00
Chem. bonded chrome	54.00
Magnesite brick	76.00
Chem. bonded magnesite	65.00

Fluorspar

Metallurgical grade, f.o.b. Ill., Ky., net ton, carloads CaF_2 content, 70% or more, $33; 65 but less than 70%, $32; 60 but less than 65% $31; less than 60%, $30. (After Aug. 29 base price any grade $30.)

Ferroalloy Prices

Ferromanganese (standard) 78-82% c.l. gross ton, duty paid, eastern, central and western zones, $135; add $6 for packed c.l., $10 for ton, $13.50 less-ton; f.o.b. cars, New Orleans, $1.70 for each 1%, or fraction contained manganese over 82% or under 78%; delivered Pittsburgh, $140.33.

Ferromanganese (Low and Medium Carbon); per lb. contained manganese; eastern zone, low carbon, bulk, c.l., 23c 2000 lb. to c.l., 23.40c; medium, 14.50c and 15.20c; central, low carbon, bulk, c.l., 23.30c; 2000 lb. to c.l., 24.40c; medium, 14.80c and 16.20c; western, low carbon, bulk, c.l., 24.50c, 2000 lb. to c.l., 25.40c; medium, 15.75c and 17.20c; f.o.b. shipping point, freight allowed.

Spiegeleisen: 19-21% carlots per gross ton, Palmerton, Pa. $36; 16-19%, $35.

Electrolytic Manganese: 99.9% plus, less ton lots, per lb. 37.6 cents.

Chromium Metal: 97% min. chromium, max. .50% carbon, eastern zone, per lb. contained chromium bulk, c.l., 79.50c, 2000 lb. to c.l. 80c; central, 81c and 82.50c; western, 82.25c and 84.75c; f.o.b. shipping point, freight allowed.

Ferrocolumbium: 50-60%, per lb. contained columbium in gross ton lots, contract basis, R.R. freight allowed, eastern zone, $2.25; less-ton lots $2.30. Spot prices 10 cents per lb. higher.

Ferrochrome: High carbon, eastern zone, bulk, c.l., 13c, 2000 lb. to c.l., 13.90c; central, add .40c and .65c; western, add 1c and 1.85c—high nitrogen, high carbon ferrochrome: Add 5c to all high carbon ferrochrome prices; all zones; low carbon eastern, bulk, c.l., max. 0.06% carbon, 23c, 0.10% 22.50c, 0.15% 22c, 0.20% 21.50c, 0.50% 21c, 1.00% 20.50c, 2.00% 19.50c; 2000 lb. to c.l., 0.06% 24c, 0.10% 23.50c, 0.15% 23c, 0.20% 22.50c, 0.50% 22c, 1.00% 21.50c, 2.00% 20.50c; central, add .4c for bulk, c.l. and .65c for 2000 lb. to c.l.; western, add 1c for bulk, c.l. and 1.85c for 2000 lb. to c.l.; carload packed differential .45c; f.o.b. shipping point, freight allowed. Prices per lb. contained Cr high nitrogen, low carbon ferrochrome: Add 2c to low carbon ferrochrome prices; all zones. For higher nitrogen carbon add 2c for each .25% of nitrogen over 0.75%.

Special Foundry ferrochrome: (Chrom. 62-66%, car. approx. 5-7%) Contract, carload, bulk, 13.50c, packed 13.95c, ton lots 14.40c, less, 14.90c, eastern, freight allowed, per pound contained chromium; 13.90c, 14.35c, 15.05c and 15.55c central; 14.50c, 14.95c, 16.25c and 16.75c, western; spot up .25c.

S.M. Ferrochrome, high carbon: (Chrom. 60-65%, sil. 4-6%, mang. 4-6% and carbon 4-6%.) Contract, carlot, bulk, 14.00c, packed, 14.45c, ton lots 14.90c, less 15.40c, eastern, freight allowed; 14.40c, 14.85c, 15.55c and 16.05c, central; 15.00c, 15.45c, 16.75c and 17.25c, western; spot up .25c; per pound contained chromium.

S.M. Ferrochrome, low carbon: (Chrom. 62-66%, sil. 4-6%, mang. 7%) Contract, carload, bulk 13.50c, 4-6% and carbon 1.25% max.) Contract, carlot, bulk, 20.00c, packed 20.45c, ton lots 21.00c, less ton lots 22.00c, eastern, freight allowed, per pound contained chromium; 20.40c, 20.85c, 21.65c and 22.65c, central; 21.00c, 21.45c, 22.85c and 23.85c, western; spot up .25c.

SMZ Alloy: (Silicon 60-65%, Mang. 5-7%, zir. 5-7% and iron approx 20%) per lb. of alloy. Contract carlots 11.50c, ton lots 12.00c, less 12.50c, eastern zone, freight allowed; 12.00c, 12.85c and 13.35c central zone; 14.05c, 14.60c and 15.10c, western; spot up .25c.

Silcaz Alloy: (Sil. 35-40%, cal. 9-11%, alum. 6-8%, Zir. 3-5%, tit. 9-11% and boron 0.55-0.75%), per lb. of alloy. Contract, carlots 25.00c, ton lots 26.00c, less ton lots 27.00c, eastern, freight allowed; 25.50c, 26.75c and 27.75c, central; 27.50c, 28.90c and 29.90c, western; spot up .25c.

Silvaz Alloy: (Sil. 35-40% van. 9-11%, alum. 5-7%, zir. 5-7%, tit. 9-11% and boron 0.55-0.75%), per lb. of alloy. Contract, carlots 58.00c, ton lots 59.00c, less 60.00c, eastern, freight allowed; 58.50c, 59.75c and 60.75c, central; 60.50c, 61.90c and 62.90c, western; spot up ¼c.

CMSZ Alloy 4: (Chr. 45-49%, mang. 4-6%, sil. 18-21%, zir. 1.25-1.75%, and car. 3.00-4.50%). Contract, carlots, bulk, 11.00c and packed 11.50c; ton lots 12.00c; less 12.50c, eastern, freight allowed; 11.50c and 12.00c, 12.75c, 13.25c, central; 13.50c and 14.00c, 14.75c, 15.25c, western; spot up .25c.

CMSZ Alloy 5: (Chr. 50-56%, mang. 4-6%, sil. 13.50-16.00%, zir. .75-1.25%, car. 3.50-5.00%) per lb. of alloy. Contract, carlots, bulk, 10.75c, packed 11.25c, ton lots 11.75c, less 12.25c, eastern, freight allowed; 11.25c, 11.75c and 12.50c, central; 13.25c and 13.75c, 14.50c and 15.00c, western, spot up .25c.

Ferro-Boron: (Bor. 17.50% min., sil. 1.50% max., alum. 0.50% max. and car. 0.50% Max.) per lb. of alloy. Contract ton lots, $1.20, less ton lots $1.30, eastern, freight allowed; $1.2075 and $1.3075 central; $1.229 and $1.329, western; spot add 5c.

Manganese-Boron: (Mang. 75% approx., boron 15-20%, iron 5% max., sil. 1.50% max. and carbon 3% max.), per lb. of alloy. Contract, ton lots, $1.89, less, $2.01, eastern, freight allowed; $1.903 and $2.023 central, $1.935 and $2.055 western, spot up 5c.

Nickel-Boron: (Bor. 15-18%, alum. 1% max., sil. 1.50% max., car. 0.50% max., iron 3% max., nickel balance), per lb. of alloy. Contract, 5 tons or more, $1.90, 1 ton to 5 tons, $2.00, less than ton $2.10, eastern, freight allowed; $1.9125, $2.0125 and $2.1125, central; $1.9445, $2.0445 and $2.1445, western; spot same as contract.

Chromium-Copper: (Chrom. 8-11%. cu. 88-90%, iron 1% max., sil. 0.50% max.) contract, any quantity, 45c, eastern, Niagara Falls, N. Y., basis, freight allowed to destination, except to points taking rate in excess of St. Louis rate, to which equivalent of St. Louis rate will be allowed; spot, up 2c.

Vanadium Oxide: (Fused: Vanadium oxide 85-88%, sodium oxide, approx. 10% and calcium oxide approx. 2%, or Red Cake: Vanadium oxide 85% approx., sodium oxide, approx. 9% and water approx.

WAREHOUSE STEEL PRICES

Base delivered price, cents per pound, for delivery within switching limits, subject to established extras.

	Hot rolled bars	Structural shapes	Plates	Floor plates	Hot rolled sheets (10 gage base)	Hot rolled bands (12 gage and heavier)	Hot rolled hoops (14 gage and lighter)	Galvanized flat sheets (24 gage base)	Cold-rolled sheets (17 gage base)	Cold finished bars	Cold-rolled strip	NE hot bars 8600 series	NE hot bars 9400 series
Boston	4.044[1]	3.912[1]	3.912[1]	5.727[1]	3.774[1]	4.106[1]	5.106[1]	5.224[14]	4.744[14]	4.144[11]	4.715	6.012[23]	6.012[23]
New York	3.853[1]	3.758[1]	3.768[1]	5.574[1]	3.590[1]	3.974[1]	3.974[1]	5.010[12]	4.613[14]	4.103[21]	4.774	.....	.....
Jersey City	3.853[1]	3.747[1]	3.768[1]	5.574[1]	3.590[1]	3.974[1]	3.974[1]	5.010[12]	4.613[14]	4.103[21]	4.774	.....	.....
Philadelphia	3.822[1]	3.666[1]	3.605[1]	5.272[1]	3.518[1]	3.922[1]	4.272[1]	5.018[15]	4.872[25]	4.072[21]	4.772	5.816[23]	5.866[23]
Baltimore	3.802[1]	3.759[1]	3.594[1]	5.252[1]	3.394[1]	3.902[1]	4.252[1]	4.894[1]	4.852[25]	4.052[21]	.....	.....	.....
Washington	3.941[1]	3.930[1]	3.796[1]	5.341[1]	3.596[1]	4.041[1]	4.391[1]	5.196[17]	4.841[20]	4.041[21]	.....	.....	.....
Norfolk, Va.	4.065[1]	4.002[1]	3.971[1]	5.465[1]	3.771[1]	4.165[1]	4.515[1]	5.371[17]	4.965[24]	4.165[21]	.....	.....	.....
Bethlehem, Pa.*	.....	3.45[1]	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Claymont, Del.*	.....	.....	3.45[1]	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Coatesville, Pa.*	.....	.....	3.45[1]	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Buffalo (city)	3.35[1]	3.40[1]	3.63[1]	5.26[1]	3.35[1]	3.819[1]	3.819[1]	4.75[18]	4.40[10]	3.75[21]	4.669	5.60[23]	5.75[23]
Buffalo (country)	3.25[1]	3.30[1]	3.30[1]	4.90[1]	3.25[1]	3.81[1]	3.50[1]	4.65[15]	4.30[10]	3.65[21]	4.35	5.60[23]	5.75[23]
Pittsburgh (city)	3.35[1]	3.40[1]	3.40[1]	5.00[1]	3.35[1]	3.60[1]	3.60[1]	4.75[13]	4.40[24]	3.75[21]	.....	.....	.....
Pittsburgh (country)	3.25[1]	3.30[1]	3.30[1]	4.90[1]	3.25[1]	3.50[1]	3.50[1]	4.65[13]	4.30[24]	3.65[21]	.....	.....	.....
Cleveland (city)	3.35[1]	3.588[1]	3.40[1]	5.188[1]	3.35[1]	3.60[1]	3.60[1]	4.877[13]	4.40[24]	3.75[21]	4.45[21]	5.60[23]	5.65[23]
Cleveland (country)	3.25[1]	.....	3.30[1]	.....	3.25[1]	3.50[1]	3.50[1]	.....	4.30[24]	3.65[21]	4.35[21]	.....	.....
Detroit	3.450[1]	3.661[1]	3.609[1]	5.281[1]	3.450[1]	3.700[1]	3.700[1]	5.000[13]	4.500[24]	3.800[21]	4.659	5.93[23]	5.93[23]
Omaha (city, delivered)	4.115[1]	4.165[1]	4.165[1]	5.765[1]	3.865[1]	4.215[1]	4.215[1]	5.608[10]	5.443[24]	4.443[21]	.....	.....	.....
Omaha (country, base)	4.015[1]	4.065[1]	4.065[1]	5.665[1]	3.765[1]	4.115[1]	4.115[1]	5.508[10]	.....	.....	.....	.....	.....
Cincinnati	3.611[1]	6.391[1]	3.661[1]	5.291[1]	3.425[1]	3.675[1]	3.675[1]	4.825[10]	4.475[24]	4.011[21]	4.711	6.10	6.20
Youngstown, O.*	.....	.....	.....	.....	.....	.....	.....	4.40[13]	.....	.....	.....	.....	.....
Middletown, O.*	.....	.....	.....	.....	3.25[1]	3.50[1]	3.50[1]	4.65[16]	.....	.....	.....	.....	.....
Chicago (city)	3.50[1]	3.55[1]	3.55[1]	5.15[1]	3.25[1]	3.60[1]	3.60[1]	5.231[15]	4.20[24]	3.75[21]	4.65	5.75[23]	5.85[23]
Milwaukee	3.637[1]	3.687[1]	3.687[1]	5.287[1]	3.387[1]	3.737[1]	3.737[1]	5.272[15]	4.337[24]	3.887[21]	4.787	5.987[23]	6.087[23]
Indianapolis	3.58[1]	3.63[1]	3.63[1]	5.23[1]	3.518[1]	3.768[1]	3.768[1]	4.918[15]	4.568[24]	3.98[21]	4.78	6.08[23]	6.18[23]
St. Paul	3.76[2]	3.81[2]	3.81[2]	5.41[2]	3.51[2]	3.86[2]	3.86[2]	5.257[15]	4.46[24]	4.361[21]	5.102	6.09[23]	6.19[23]
St. Louis	3.647[1]	3.697[1]	3.697[1]	5.297[1]	3.397[1]	3.747[1]	3.747[1]	5.172[15]	4.347[24]	4.031[21]	4.931	6.131[23]	6.231[23]
Memphis, Tenn.	4.015[5]	4.065[5]	4.065[5]	5.78[5]	3.965[5]	4.215[5]	4.215[5]	5.265[15]	4.78[24]	4.33[21]	.....	.....	.....
Birmingham	3.50[1]	3.55[1]	3.55[1]	5.903[1]	3.45[1]	3.70[1]	3.70[1]	4.75[15]	4.852[24]	4.54	5.215	.....	.....
New Orleans (city)	4.10[4]	3.90[4]	3.90[4]	5.85[4]	4.058[4]	4.20[4]	4.20[4]	5.25[26]	5.079[10]	4.60[21]	5.429	.....	.....
Houston, Tex.	3.75[3]	4.25[3]	4.25[3]	5.50[3]	3.763[3]	4.313[3]	4.313[3]	5.313[26]	4.10[10]	3.65[22]	.....	.....	.....
Los Angeles	4.40[4]	4.65[4]	4.95[4]	7.20[4]	5.00[4]	4.95[4]	6.75[4]	6.00[18]	7.20[6]	5.583[22]	5.613	5.85[23]	5.95[23]
San Francisco	4.15[7]	4.35[7]	4.65[7]	6.35[7]	4.55[7]	4.50[7]	5.75[7]	6.35[15]	7.30[15]	5.333[21]	7.333	8.304[23]	8.404[23]
Portland, Oreg.	4.45[27]	4.45[27]	4.75[27]	6.50[27]	4.65[27]	4.75[27]	6.30[27]	5.75[15]	6.60[15]	5.533[15]	.....	.....	.....
Tacoma	4.35[6]	4.45[6]	4.75[6]	6.50[6]	4.65[6]	4.25[6]	5.45[6]	5.95[15]	7.60[15]	5.783[21]	.....	.....	8.00[23]
Seattle	4.35[6]	4.45[6]	4.75[6]	6.50[6]	4.65[6]	4.25[6]	5.45[6]	5.95[15]	7.05[15]	5.783[21]	.....	.....	8.00[23]

*Basing point cities with quotations representing mill prices, plus warehouse spread.

NOTE—All prices fixed by Office of Price Administration in Amendments Nos. 10 to 18 to Revised Price Schedule No. 49. Deliveries outside above cities computed in accordance with regulations.

BASE QUANTITIES

[1]—400 to 1999 pounds; [2]—400 to 14,999 pounds; [3]—any quantity; [4]—300 to 1999 pounds; [5]—400 to 8999 pounds; [6]—300 to 9999 pounds; [7]—400 to 39,999 pounds; [8]—under 2000 pounds; [9]—under 4000 pounds; [10]—500 to 1499 pounds; [11]—one bundle to 39,999 pounds; [12]—150 to 2249 pounds; [13]—150 to 1499 pounds; [14]—three to 24 bundles; [15]—450 to 1499 pounds; [16]—one bundle to 1499 pounds; [17]—one to nine bundles; [18]—one to six bundles; [19]—100 to 749 pounds; [20]—300 to 1999 pounds; [21]—1500 to 39,999 pounds; [22]—1500 to 1999 pounds; [23]—1000 to 39,999 pounds; [24]—400 to 1499 pounds; [25]—1000 to 1999 pounds; [26]—under 25 bundles. Cold-rolled strip, 2000 to 39,999 pounds, base; [27]—300 to 4999 pounds.

Ores

Lake Superior Iron Ore

Gross ton, 51½% (Natural) Lower Lake Ports

Old range bessemer	$4.75
Mesabi nonbessemer	4.45
High phosphorus	4.35
Mesabi bessemer	4.60
Old range nonbessemer	4.60

Eastern Local Ore

Cents, units, del. E. Pa.

Foundry and basic 56-63% contract	13.00

Foreign Ore

Cents per unit, c.i.f. Atlantic ports

Manganiferous ore, 45-55% Fe., 6-10% Mang.	Nom.
N. African low phos.	Nom.
Spanish, No. African basic, 50 to 60%	Nom.
Brazil iron ore, 68-69% f.o.b. Rio de Janeiro	7.50-8.00

Tungsten Ore

Chinese wolframite, per short ton unit, duty paid	$24.00

Chrome Ore

(Equivalent OPA schedules):

Gross ton f.o.b. cars, New York, Philadelphia, Baltimore, Charleston, S. C., Portland, Ore., or Tacoma, Wash.

(S/S paying for discharging; dry basis; subject to penalties if guarantees are not met.)

Indian and African

48% 2.8:1	$41.00
48% 3:1	43.50
48% no ratio	31.00

South African (Transvaal)

44% no ratio	$27.40
45% no ratio	28.30
48% no ratio	31.00
50% no ratio	32.80

Brazilian—nominal

44% 2.5:1 lump	33.65
48% 3:1 lump	43.50

Rhodesian

45% no ratio	28.30
48% no ratio	31.00
48% 3:1 lump	43.50

Domestic (seller's nearest rail)

48% 3:1	52.80

less $7 freight allowance

Manganese Ore

Sales prices of Metals Reserve Co., cents per gross ton unit, dry, 48%, at New York, Philadelphia, Baltimore, Norfolk, Mobile and New Orleans, 85.0c; Fontana, Calif., Provo, Utah, and Pueblo, Colo., 91.0c; prices include duty on imported ore and are subject to premiums, penalties and other provisions of amended M.P.R. No. 248, effective as of May 15. Price at basing points which are also points of discharge of imported manganese ore is f.o.b. cars, shipside, at dock most favorable to the buyer.

Molybdenum

Sulphide conc., lb., Mo. cont., mines	$0.75

NATIONAL EMERGENCY STEELS (Hot Rolled)

(Extras for alloy content)

Designation	Chemical Composition Limits, Per Cent — Carbon	Mn.	Si.	Cr.	Ni.	Mo.	Basic open-hearth Electric furnace Bars per 100 lb.	Billets per GT	Bars per 100 lb.	Billets per GT
NE 1330	.28-.33	1.60-1.90	.20-.35	.....	.....	.....	$ .10	$ 2.00	.....	.....
NE 8613	.12-.17	.70- .90	.20-.35	.40-.60	.40-.70	.15-.25	.65	13.00	1.15	23.00
NE 8720	.18-.23	.70- .90	.20-.35	.40-.60	.40-.70	.20-.30	.70	14.00	1.20	24.00
NE 9255	.50-.60	.70- .95	1.80-2.20	.....	.....	.....	.40	8.00	.....	.....
NE 9261	.55-.65	.70-1.00	1.80-2.20	.10-.25	.....	.....	.65	13.00	.....	.....
NE 9262	.55-.65	.70-1.00	1.80-2.20	.25-.40	.....	.....	.65	13.00	.....	.....
NE 9415	.13-.18	.80-1.10	.20-.35	.30-.50	.30-.60	.08-.15	.75	15.00	1.25	25.00
NE 9425	.23-.28	.90-1.20	.20-.35	.30-.50	.30-.60	.08-.15	.75	15.00	1.25	25.00
NE 9442	.40-.45	1.00-1.30	.20-.35	.30-.50	.30-.60	.08-.15	.80	16.00	1.30	26.00

Extras are in addition to a base price of 2.70c, per pound on finished products and $54 per gross ton on semifinished steel major basing points and are in cents per pound and dollars per gross ton. No prices quoted on vanadium alloy.

2.5%) Contract, any quantity, $1.10 eastern, freight allowed, per pound vanadium oxide contained; contract, carlots, $1.105, less carlots, $1.108, central; $1.118 and $1.133, western; spot add 5c to contracts in all cases.

Calcium metal; cast: Contract, ton lots or more $1.80, less, $2.30. eastern zone, freight allowed, per pound of metal; $1.809 and $2.309, Central, $1.849 and $2.349, western; spot up 5c.

Calcium-Manganese-Silicon: (Cal. 16-20%, mang. 14-18% and sil. 53-59%), per lb. of alloy. Contract, carlots, 15.50c, ton lots 16.50c and less 17.00c, eastern, freight allowed; 16.00c, 17.35c and 17.85c, central; 18.05c, 19.10c and 19.60c western; spot up .25c.

Calcium-Silicon: (Cal. 30-35%, sil. 60-65% and iron 3.00% max.), per lb. of alloy. Contract, carlot, lump 13.00c, ton lots 14.50c, less 15.50c, eastern, freight allowed; 13.50c, 15.25c and 16.25c central; 15.55c, 17.40c and 18.40c, western; spot up .25c.

Briquets, Ferromanganese: (Weight approx. 3 lbs. and containing exactly 2 lbs. mang.), per lb. of briquets. Contract, carlots, bulk .0605c, packed .063c, tons .0655c, less .068c, eastern, freight allowed; .063c, .0655c, .0755c and .078c, central; .066c, .0685c, .0855c and .088c, western; spot up .25c.

Briquets: Ferrochrome, containing exactly 2 lb. cr., eastern zone, bulk, c.l., 8.25c per lb. of briquets, 2000 lb. to c.l., 8.75c; central, add .3c for c.l. and .5c for 2000 lb. to c.l.; western, add .70c for c.l., and .2c for 2000 lb. to c.l.; **silicomanganese,** eastern, containing exactly 2 lb. manganese and approx. ½ lb. silicon, bulk, c.l., 5.80c, 2000 lbs. to c.l., 6.30c; central, add .25c for c.l. and 1c for 2000 lb. to c.l.; western, add .5c for c.l., and 2c for 2000 lb. to c.l.; **ferrosilicon,** eastern, approx. 5 lb., containing exactly 2 lb. silicon, or weighing approx. 2½ lb. and containing exactly 1 lb. of silicon, bulk, c.l., 3.35c, 2000 lb. to c.l., 3.80c; central, add 1.50c for c.l., and .40c for 2000 lb. to c.l.; western, add 3.0c for c.l. and .45c for 2000 to c.l.; f.o.b. shipping point, freight allowed.

Ferromolybdenum: 55-75% per lb. contained molybdenum, f.o.b. Langeloth and Washington, Pa., furnace, any quantity 95.00c.

Ferrophosphorus: 17-19%, based on 18% phosphorus content, with unitage of $3 for each 1% of phosphorus above or below the base; gross tons per carload f.o.b. sellers' works, with freight equalized with Rockdale, Tenn.; contract price $58.50, spot $62.25.

Ferrosilicon: Eastern zone, 90-95%, bulk, c.l., 11.05c, 2000 lb. to c.l., 12.30c; 80-90%, bulk c.l., 8.90c, 2000 lb. to c.l., 9.95c; 75%, bulk, c.l., 8.05c, 2000 lb. to c.l., 9.05c; 50%, bulk c.l., 6.65c and 2000 lb. to c.l., 7.85c; central 90-95%, bulk, c.l., 11.20c, 2000 lb. to c.l., 12.80c; 80-90%, bulk, c.l., 9.05c, 2000 to c.l., 10.45c; 75%, bulk, c.l., 8.20c, 2000 lb. to c.l., 9.65c; 50% bulk, c.l., 7.10c, 2000 lb. to c.l., 9.70c; western, 90-95%, bulk, c.l., 11.65c, 2000 lb. to c.l., 15.60c; 80-90%, bulk, c.l., 9.55c, 2000 lb. to c.l., 13.50c; 75%, bulk, c.l., 8.75c, 2000 to c.l., 13.10c; 50%, bulk, c.l., 7.25c, 2000 to c.l., 8.75c; f.o.b. shipping point, freight allowed. Prices per lb. contained silicon.

Silicon Metal: Min. 97% silicon and max. 1% iron, eastern zone, bulk, c.l., 12.90c, 2000 lb. to c.l., 13.45c; central, 13.20c and 13.90c; western, 13.85c and 16.80c; min. 96% silicon and max. 2% iron, eastern, bulk, c.l., 12.50c, 2000 lb. to c.l., 13.10c; central, 12.80c and 13.55c; western, 13.45c and 16.50c; f.o.b. shipping point, freight allowed. Prices per lb. contained silicon.

Manganese Metal: (96 to 98% manganese, max. 2% iron), per lb. of metal, eastern zone, bulk, c.l., 36c, 2000 lb. to c.l., 38c, central, 36.25c, and 39c; western, 36.55c and 41.05c; 95 to 97% manganese, max. 2.50% iron, eastern, bulk, c.l., 34c; 2000 c.l., 35c; central, 34.25c and 36c; western, 34.55c and 38.05c; f.o.b. shipping point, freight allowed.

Ferrotungsten: Carlots, per lb. contained tungsten, $1.90.

Tungsten Metal Powder: 98-99% per lb. any quantity $2.55-2.65.

Ferrotitanium: 40-45%, R.R. freight allowed, per lb. contained titanium; ton lots $1.23; less-ton lots $1.25; eastern. Spot up 5 cents per lb.

Ferrotitanium: 20-25%, 0.10 maximum carbon; per lb. contained titanium; ton lots $1.35; less-ton lots $1.40; eastern. Spot 5 cents per lb. higher.

High-Carbon Ferrotitanium: 15-20% contract basis, per gross ton, f.o.b. Niagara Falls, N. Y., freight allowed to destination east of Mississippi River and North of Baltimore and St. Louis, 6-8% carbon $142.50; 3-5% carbon $157.50.

Carbortam: Boron 0.90 to 1.15%, net ton to carload, 8c lb. F.O.B. Suspension Bridge, N. Y., frt. allowed same as high-carbon ferrotitanium.

Bortam: Boron 1.5-1.9%, ton lots 45c lb., less ton lots 50c lb.

Ferrovanadium: 35-55%, contract basis, per lb. contained vanadium, f.o.b. producers plant with usual freight allowances; open-hearth grade $2.70; special grade $2.80; highly-special grade $2.90.

Zirconium Alloys: 12-15%, per lb. of alloy, eastern, contract, carlots, bulk, 4.60c, packed 4.80c, ton lots 4.80c, less tons 5c, carloads bulk, per gross ton $102.50; packed $107.50; ton lots $108; less-ton lots $112.50. Spot ¼c per ton higher.

Zirconium Alloy: 35-40%, Eastern, contract basis, carloads in bulk or package, per lb. of alloy 14.00c; gross ton lots 15.00c; less-ton lots 16.00c. Spot ¼-cent higher.

Alsifer: (Approx. 20% aluminum, 40% silicon, 40% iron) contract basis f.o.b. Niagara Falls, N. Y., per lb. 5.75; ton lots 6.50c. Spot ½ cent higher.

Simanal: (Approx. 20% each silicon, manganese, aluminum) Contract basis, freight allowed, per lb. of alloy; carlots 8.75c; ton lots 9.25c, less ton lots, 9.75c.

Boresil: 3 to 4% boron, 40 to 45% Si., $6.25 lb. cont. Bo., f.o.b. Philo, O., freight not exceeding St. Louis rate allowed.

OPEN MARKET PRICES, IRON AND STEEL SCRAP

Following prices are below-ceiling quotations developed by editors of STEEL in the various centers. For complete OPA ceiling price schedule refer to page 156 of Sept. 4, 1944, issue of STEEL.

PHILADELPHIA:

(Delivered consumer's plant)

No. 1 Heavy Melt. Steel	$18.75
No. 2 Heavy Melt. Steel	18.75
No. 1 Bundles	18.75
No. 2 Bundles	18.75
No. 3 Bundles	16.75
Machine Shop Turnings	13.00-13.50
Mixed Borings, Turnings	13.00-13.50
Shoveling Turnings	15.00
No. 2 Busheling	15.00
Billet, Forge Crops	21.25
Bar Crops, Plate Scrap	21.25
Cast Steel	21.25
Punchings	21.25
Elec. Furnace Bundles	19.75
Heavy Turnings	18.25

Cast Grades

(F.o.b. Shipping Point)

Heavy Breakable Cast	16.50
Charging Box Cast	19.00
Cupola Cast	20.00
Unstripped Motor Blocks	17.50
Malleable	22.00
Chemical Borings	16.51

NEW YORK:

(Dealers' buying prices.)

No. 1 Heavy Melt. Steel	$15.33
No. 2 Heavy Melt. Steel	15.33
No. 2 Hyd. Bundles	15.33
No. 3 Hyd. Bundles	13.33
Chemical Borings	14.33
Machine Turning	9.50
Mixed Borings, Turnings	9.50
No. 1 Cupola	20.00
Charging Box	19.00
Heavy Breakable	16.50
Unstrip Motor Blocks	17.50
Stove Plate	19.00

CLEVELAND:

(Delivered consumer's plant)

No. 1 Heavy Melt. Steel	$19.50
No. 2 Heavy Melt. Steel	19.50
No. 1 Comp. Bundles	19.50
No. 2 Comp. Bundles	19.50
No. 1 Busheling	19.50
Mach. Shop Turnings	13.50-14.00
Short Shovel Turnings	15.50-16.00
Mixed Borings, Turnings	13.50-14.00
No. 1 Cupola Cast	20.00
Heavy Breakable Cast	16.50
Cast Iron Borings	15.50
Billet, Bloom Crops	24.50
Sheet Bar Crops	22.00
Plate Scrap, Punchings	22.00
Elec. Furnace Bundles	20.50

BOSTON:

(F.o.b. shipping points)

No. 1 Heavy Melt. Steel	$14.06*
No. 2 Heavy Melt. Steel	14.06*
No. 1 Bundles	14.06*
No. 2 Bundles	13.00
No. 1 Busheling	14.05*
Machine Shop Turnings	8.00
Mixed Borings, Turnings	7.75
Short Shovel, Turnings	10.15
Chemical Borings	14.80
Low Pos. Clippings	16.50
No. 1 Cast	20.00
Clean Auto Cast	20.00
Stove Plate	19.00
Heavy Breakable Cast	16.50

*Inland base ceiling; at ports switching district price 99 cents, Boston, to $1.09, Providence, higher.

PITTSBURGH:

(Delivered consumer's plant)

Railroad Heavy Melting	$21.00*
No. 1 Heavy Melt. Steel	20.00*
No. 2 Heavy Melt. Steel	20.00*
No. 1 Comp. Bundles	20.00*
No. 2 Comp. Bundles	20.00*
Mach. Shop Turnings	13.00
Short Shovel, Turnings	16.00
Mixed Borings, Turnings	13.00
No. 1 Cupola Cast	20.00*
Heavy Breakable Cast	16.50*
Cast Iron Borings	14.00
Billet, Bloom Crops	25.00*
Sheet Bar Crops	22.50*
Plate Scrap, Punchings	22.50*
Railroad Specialties	24.50*
Scrap Rail	21.50*
Axles	26.00*
Rail 3 ft. and under	23.50*
Railroad Malleable	21.00*

*Ceiling price.

VALLEY:

(Delivered consumer's plant)

No. 1 R.R. Hvy. Melt.	$21.00
No. 1 Heavy Melt. Steel	20.00
No. 1 Comp. Bundles	20.00
Short Shovel Turnings	17.00
Cast Iron Borings	16.00
Machine Shop Turnings	15.00
Low Phos. Plate	21.00-22.00

MANSFIELD, O.:

(Delivered consumer's plant)

Machine Shop Turnings	11.00

BIRMINGHAM:

(Delivered consumer's plant)

Billet, Forge Crops	$17.00
Structural, Plate Scrap	16.00-16.50
Scrap Rails, Random	15.00-15.50
Rerolling Rails	17.50-18.00
Angle, Splice Bars	16.50-17.00
Solid Steel Axles	14.50-15.00
Cupola Cast	21.00
Stove Plate	16.50-17.00

CHICAGO:

(Delivered consumer's plant)

No. 1, R.R. Hvy. Melt.	$19.75
No. 1 Heavy Melt. Steel	18.75
No. 2 Heavy Melt. Steel	18.75
No. 1 Ind. Bundles	18.75
No. 2 Dir. Bundles	18.75
No. 3 Galv. Bundles	16.75
Machine Turnings	10.00-10.50
Mix. Borings, Sht. Turn.	11.00-11.50
Short Shovel Turnings	11.50-12.00
Cast Iron Borings	11.00-11.50
Scrap Rails	20.25
Cut Rails, 3 feet	22.25
Cut Rails, 18-inch	23.50
Angles, Splice Bars	22.25
Plate Scrap, Punchings	21.25
Railroad Specialties	22.75
No. 1 Cast	20.00
R.R. Malleable	22.00

(Cast grades f.o.b. shipping point, railroad grades f.o.b. tracks)

BUFFALO:

(Delivered consumer's plant)

No. 1 Heavy Melt. Steel	$19.25*
No. 2 Heavy Melt. Steel	19.25*
No. 1 Bundles	19.25*
No. 2 Bundles	19.25*
No. 1 Busheling	19.25
Machine Turnings	11.00-11.50
Short Shovel. Turnings	16.00-16.50
Heavy Breakable Cast	16.00-16.50
Mixed Borings, Turn.	12.00-12.50
Cast Iron Borings	12.00-12.50
Low Phos.	21.75*

*Ceiling price.

DETROIT:

(Dealers' buying prices)

Heavy Melting Steel	$17.32*
No. 1 Busheling	17.32*
Hydraulic Bundles	17.32*
Flashings	17.32*
Machine Turnings	8.50- 9.00
Short Turnings	11.50-12.00
Cast Iron Borings	10.50-11.00
Low Phos. Plate	19.82*
No. 1 Cast	20.00*
Heavy Breakable Cast	13.50-14.00

*Ceiling price.

ST. LOUIS:

(Delivered consumer's plant)

Heavy Melting	$17.50
No. 1 Locomotive Tires	17.50-18.00
Misc. ails	19.00
Railroad Springs	19.50-20.00
Bundled Sheets	13.00-13.50
Axle Turnings	14.00-14.50
Machine Turnings	7.50- 8.00
Rerolling Rails	21.00
Steel Car Axles	21.00-21.50
Steel Rails, 3 ft.	21.50
Steel Angle Bars	18.50-19.00
Cast Iron Wheels	20.00
No. 1 Machinery Cast	20.00
Railroad Malleable	20.00-20.50
Breakable Cast	16.50
Stove Plate	18.00
Grate Bars	15.25
Brake Shoes	15.25

(Cast grades f.o.b. shipping point)

Stove Plate	18.00

CINCINNATI:

(Delivered consumer's plant)

No. 1 Heavy Melt. Steel	$18.50
No. 2 Heavy Melt. Steel	18.50
No. 1 Comp. Bundles	18.50
No. 2 Comp. Bundles	18.50
Machine Turnings	7.00- 7.50
Shoveling Turnings	7.50- 8.00
Cast Iron Borings	8.00- 8.50
Mixed Borings, Turnings	7.00- 7.50
No. 1 Cupola Cast	20.00
Breakable Cast	15.00-15.50
Low Phosphorus	20.00-21.00
Scrap Rails	21.50
Stove Plate	16.00-16.50

LOS ANGELES:

(Delivered consumer's plant)

No. 1 Heavy Melt. Steel	$14.00
No. 2 Heavy Melt. Steel	13.00
No. 1, 2 Deal. Bundles	12.00
Machine Turnings	4.00
Mixed Borings, Turnings	4.00
No. 1 Cast	20.00

SAN FRANCISCO:

(Delivered consumer's plant)

No. 1 Heavy Melt. Steel	$15.50
No. 2 Heavy Melt. Steel	14.50
No. 1 Busheling	15.50
No. 1, No. 2 Bundles	13.50
No. 3 Bundles	9.00
Machine Turnings	6.00
Billet, Forge Crops	15.50
Bar Crops, Plate	15.50
Cast Steel	15.50
Cut Structural, Plate, 1", under	18.00
Alloy-free Turnings	7.50
Tin Can Bundles	14.50
No. 2 Steel Wheels	16.00
Iron, Steel Axles	23.00
No. 2 Cast Steel	15.00
Uncut Frogs, Switches	16.00
Scrap Rails	16.00
Locomotive Tires	16.00

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NONFERROUS METAL PRICES

Copper: Electrolytic or Lake from producers in carlots 12.00c, Del. Conn., less carlots 12.12½c, refinery; dealers may add ¾c for 5000 lbs. to carload; 1000-4999 lbs. 1c; 500-999 1½c; 0-499 2c. Casting, 11.75c, refinery for 20,000 lbs., or more, 12.00c less than 20,000 lbs.

Brass Ingot: Carlot prices, including 25 cents per hundred freight allowance; add ¼c for less than 20 tons; 85-5-5-5 (No. 115) 13.00c; 88-10-2 (No. 215) 16.50c; 80-10-10 (No. 305) 15.75c; Navy G (No. 225) 16.75c; Navy M (No. 245) 14.75c; No. 1 yellow (No. 405) 10.00c; manganese bronze (No. 420) 12.75c.

Zinc: Prime western 8.25c, select 8.35c, brass special 8.50c, intermediate 8.75c, E. St. Louis, for carlots. For 20,000 lbs. to carlots add 0.15c; 10,000-20,000 0.25c; 2000-10,000 0.40c; under 2000 0.50c.

Lead: Common 6.35c, chemical, 6.40c, corroding, 6.45c, E. St. Louis for carloads; add 5 points for Chicago, Minneapolis-St. Paul, Milwaukee-Kenosha districts; add 15 points for Cleveland-Akron-Detroit area, New Jersey, New York state, Texas, Pacific Coast, Richmond, Indianapolis-Kokomo; add 20 points for Birmingham, Connecticut, Boston-Worcester-Springfield, New Hampshire, Rhode Island.

Primary Aluminum: 99% plus, ingots 15.00c del., pigs 14.00c del.; metallurgical 94% min. 13.50c del. Base 10,000 lbs. and over; add ½c 2000-9999 lbs.; 1c less than 2000 lbs.

Secondary Aluminum: All grades 12.50c per lb. except as follows: Low-grade piston alloy (No. 122 type) 10.50c; No. 12 foundry alloy (No. 2 grade) 10.50c; chemical warfare service ingot (92½% plus) 10.00c; steel deoxidizers in notch bars, granulated or shot, Grade 1 (95-97½%) 11.00c, Grade 2 (92-95%) 9.50c to 9.75c, Grade 3 (90-92%) 8.50c to 8.75c, Grade 4 (85-90%) 7.50c to 8.00c; any other ingot containing over 1% iron, except PM 754 and hardness, 12.00c. Above prices for 30,000 lb. or more; add ¼c 10,000-30,000 lb.; ½c 1000-10,000 lbs.; 1c less than 1000 lbs. Prices include freight at carload rate up to 75 cents per hundred.

Magnesium: Commercially pure (99.8%) standard ingots (4-notch, 17 lbs.), 20.50c lb., add 1c for special shapes and sizes. Alloy ingots, incendiary bomb alloy, 23.40c; 50-50 magnesium-aluminum, 23.75c; ASTM B93-41T, Nos. 2, 3, 4, 12, 13, 14, 17, 23.00c; Nos. 4X, 11, 13X, 17X, 25.00c; ASTM B107-41T, or B-90-41T, No. 8X, 23.00c; No. 18, 23.50c; No. 18X, 25.00c. Selected magnesium crystals, crowns, and muffs, including all packing screening, barrelling, handling, and other preparation charges, 23.50c. Prices for 100 lbs. or more; for 25-100 lbs., add 10c; for less than 25 lbs., 20c. Incendiary bomb alloy, f.o.b. plant, any quantity; carload freight allowed all other alloys for 500 lbs. or more.

Tin: Prices ex-dock, New York in 5-ton lots. Add 1 cent for 2240-11,199 lbs., 1½c 1000-2239. 2½c 500-999, 3c under 500. Grade A, 99.8% or higher (includes Straits), 52.00c; Grade B, 99.8% or higher, not meeting specifications for Grade A, with 0.05 per cent maximum arsenic, 51.87½c; Grade C, 99.65-99.79% incl. 51.62½c; Grade D, 99.50-99.64% incl., 51.50c; Grade E, 99-99.49% incl. 51.12½c; Grade F, below 99% (for tin content), 51.00c.

Antimony: American, bulk carlots f.o.b. Laredo, Tex., 99.0% to 99.8% and 99.8% and over but not meeting specifications below, 14.50c; 99.8% and over (arsenic, 0.05%, max. and other impurities, 0.1%, max.) 15.00c. On producers' sales add ¼c for less than carload to 10,000 lb.; ½c for 9999-224-lb.; and 2c for 223 lb. and less; on sales by dealers, distributors and jobbers add ½c, 1c, and 3c, respectively.

Nickel: Electrolytic cathodes, 99.5%, f.o.b. refinery 35.00c lb.; pig and shot produced from electrolytic cathodes 36.00c; "F" nickel shot or ingot for additions to cast iron, 34.00c; Monel shot 28.00c.

Mercury: OPA ceiling prices per 76-lb. flask f.o.b. point of shipment or entry. Domestic produced in Calif., Oreg., Wash., Idaho, Nev., Ariz., $191; produced in Texas, Ark. $193. Foreign, produced in Mexico, duty paid, $193. Open market, spot, New York, nominal for 50 to 100 flasks; $118 to $120 in smaller quantities.

Arsenic: Prime, white, 99%, carlots, 4.00c lb.

Beryllium-Copper: 3.75-4.25% Be., $17 lb. contained Be.

Cadmium: Bars, ingots, pencils, pigs, plates, rods, slabs, sticks and all other "regular" straight or flat forms 90.00c lb., del.; anodes, balls, discs and all other special or patented shapes 95.00c lb. del.

Cobalt: 97-99%, $1.50 lb. for 550 lb. (bbl.); $1.52 lb. for 100 lb. (case); $1.57 lb. under 100 lb.

Indium: 99.9%, $7.50 per troy ounce.

Gold: U. S. Treasury, $35 per ounce.

Silver: Open market, N. Y. 44.75c per ounce.

Platinum: $35 per ounce.

Iridium: $165 per troy ounce.

Palladium: $24 per troy ounce.

Rolled, Drawn, Extruded Products

(Copper and brass product prices based on 12.00c, Conn., for copper. Freight prepaid on 100 lbs. or more.)

Sheet: Copper 20.87c; yellow brass 19.48c; commercial bronze, 90% 21.07c, 95% 21.28c; red brass, 80% 20.15c, 85% 20.36c; phosphor bronze, Grades A and B 5% 36.25c; Everdur, Herculoy, Duronze or equiv. 26.00c; naval brass 24.50c; manganese bronze 28.00c; Muntz metal 22.75c; nickel silver 5% 26.50c.

Rods: Copper, hot-rolled 17.37c, cold-rolled 18.37c; yellow brass 15.01c; commercial bronze 90% 21.32c, 95% 21.53c; red brass 80% 20.40c, 85% 20.61c; phosphor bronze Grade A, B 5% 36.50c; Everdur, Herculoy, Duronze or equiv. 25.50c; Naval brass 19.12c; manganese bronze 22.50c; Muntz metal 18.87c; nickel silver 5% 26.50c.

Seamless Tubing: Copper 21.37c; yellow brass 22.23c; commercial bronze 90% 23.47c; red brass 80% 22.80c, 85% 23.01c.

Extruded Shapes: Copper 20.87c; architectural bronze 19.12c; manganese bronze 24.00c, Muntz metal 20.12c; Naval brass 20.37c.

Angles and Channels: Yellow brass 27.98c; commercial bronze 90% 29.57c, 95% 29.78c; red brass 80% 28.65c, 85% 28.86c.

Copper Wire: Soft, f.o.b. Eastern mills, carlots 15.37½c, less-carlots 15.87½c; weatherproof, f.o.b. Eastern mills, carlots 17.00c, less-carlots 17.50c; magnet, delivered, carlots 17.50c, 15,000 lbs. or more 17.75c, less carlots 18.25c.

Aluminum Sheets and Circles: 2s and 3s, flat, mill finish, base 30,000 lbs. or more; del.; sheet widths as indicated; circle diameters 9" and larger:

Gage	Width	Sheets	Circles
.249"-7	12"-48"	22.70c	25.20c
8-10	12"-48"	23.20c	25.70c
11-12	26"-48"	24.20c	27.00c
13-14	26"-48"	25.20c	28.50c
15-16	26"-48"	26.40c	30.40c
17-18	26"-48"	27.90c	32.90c
19-20	24"-42"	29.80c	35.30c
21-22	24"-42"	31.70c	37.20c
23-24	3"-24"	25.60c	29.20c

Lead Products: Prices to jobbers; full sheets 9.50c; cut sheets 9.75c; pipe 8.15c, New York; 8.25c, Philadelphia, Baltimore, Rochester and Buffalo; 8.75c, Chicago, Cleveland, Worcester, Boston.

Zinc Products: Sheet f.o.b. mill, 13.15c; 36,000 lbs. and over deduct 7%. Ribbon and strip 12.25c, 3000-lb. lots deduct 1%, 6000 lbs. 2% 9000 lbs. 3%, 18,000 lbs. 4%, carloads and over 7%. Boiler plate (not over 12") 3 tons and over 11.00c; 1-3 tons 12.00c; 500-2000 lbs. 12.50c; 100-500 lbs. 13.00c; under 100 lbs. 14.00c. Hull plate (over 12") add 1c to boiler plate prices.

Plating Materials

Chromic Acid: 99.75%, flake, del., carloads 16.25c; 5 tons and over 16.75c; 1-5 tons 17.25c; 400 lbs. to 1 ton 17.75c; under 400 lbs. 18.25c.

Copper Anodes: Base 2000-5000 lbs., del.; oval 17.62c; untrimmed 18.12c; electro-deposited 17.37c.

Copper Carbonate: 52-54% metallic cu, 250 lb. barrels 20.50c.

Copper Cyanide: 70-71% cu, 100-lb. kegs or bbls. 34.00c f.o.b. Niagara Falls.

Sodium Cyanide: 96%, 200-lb. drums 15.00c; 10,000-lb. lots 13.00c f.o.b. Niagara Falls.

Nickel Anodes: 500-2999 lb. lots; cast and rolled carbonized 47.00c; rolled, depolarized 48.00c.

Nickel Chloride: 100-lb. kegs or 275-lb. bbls. 18.00c lb., del.

Tin Anodes: 1000 lbs. and over 58.50c, del.; 500-999 59.00c; 200-499 59.50c; 100-199 61.00c.

Tin Crystals: 400 lb. bbls. 39.00c f.o.b. Grasselli, N. J.; 100-lb. kegs 39.50c.

Sodium Stannate: 100 or 300-lb. drums 36.50c, del.; ton lots 33.50c.

Zinc Cyanide: 100-lb. kegs or bbls. 33.00c, f.o.b. Niagara Falls.

Scrap Metals

Brass Mill Allowances: Prices for less than 15,000 lbs. f.o.b. shipping point. Add ⅝c for 15,000-40,000 lbs.; 1c for 40,000 lbs. or more.

	Clean Heavy	Rod Ends	Clean Turnings
Copper	10.250	10.250	9.500
Tinned Copper	9.625	9.625	9.375
Yellow Brass	8.625	8.375	7.875
Commercial bronze 90%	9.375	9.125	8.625
95%	9.500	9.250	8.750
Red Brass, 85%	9.125	8.875	8.375
Red Brass, 80%	9.125	8.875	8.375
Muntz metal	8.000	7.750	7.250
Nickel Sil., 5%	9.250	9.000	4.625
Phos. br., A, B, 5%	11.000	10.750	9.750
Herculoy, Everdur or equivalent	10.250	10.000	9.250
Naval brass	8.250	8.000	7.500
Mang. bronze	8.250	3.000	7.500

Other than Brass Mill Scrap: Prices apply on material not meeting brass mill specifications and are f.o.b. shipping point; add ¾c for shipment of 60,000 lbs. of one group and ½c for 20,000 lbs. of second group shipped in same car. Typical prices follow:

(Group 1) No. 1 heavy copper and wire, No. 1 tinned copper, copper borings 9.75c; No. 2 copper wire and mixed heavy copper, copper tuyeres 8.75c.

(Group 2) soft red brass and borings, aluminum bronze 9.00c; copper-nickel and borings 9.25c; car boxes, cocks and faucets 7.75c; bell metal 15.50c; babbit-lined brass bushings 13.00c.

(Group 3) zincy bronze borings, Admiralty condenser tubes, brass pipe 7.50c; Muntz metal condenser tubes 7.00c; yellow brass 6.25c; manganese bronze (lead 0.00%-0.40%) 7.25c, (lead 0.41%-1.0%) 6.25c; manganese bronze borings (lead 0.00-0.40%) 6.50c, (lead 0.41-1.00%) 5.50c.

Aluminum Scrap: Prices f.o.b. point of shipment, respectively for lots of less than 1000 lbs.; 1000-20,000 lbs. and 20,000 lbs. or more, plant scrap only. Segregated solids: S-type alloys (2S, 3S, 17S, 18S, 24S, 32S, 52S) 9.00c, 10.00c, 10.50c; All other high grade alloys 8.50c, 9.50c, 10.00c; low grade alloys 8.00c, 9.00c, 9.50c. Segregated borings and turnings: Wrought alloys (17S, 18S, 32S, 52S) 7.50c, 8.50c, 9.00c; all other high grade alloys 7.00c, 8.00c, 8.50c; low grade alloys 6.50c, 7.50c, 8.00c. Mixed plant scrap, all solids, 7.50c, 8.50c, 9.00c; borings and turnings 5.50c, 6.50c, 7.00c.

Lead Scrap: Prices f.o.b. point of shipment. For soft and hard lead, including cable lead, deduct 0.55c from basing point prices for refined metal.

Zinc Scrap: New clippings, old zinc 7.25c f.o.b. point of shipment; add ½-cent for 10,000 lbs. or more: New die-cast scrap, radiator grilles 4.95c, add ½c 20,000 or more. Unsweated zinc dross, die cast slab 5.80c any quantity.

Nickel, Monel Scrap: Prices f.o.b. point of shipment; add ½c for 2000 lbs. or more of nickel or cupro-nickel shipped at one time and 20,000 lbs. or more of Monel. Converters (dealers) allowed 2c premium.

Nickel: 98% or more nickel and not over ½% copper 26.00c; 90-98% nickel, 26.00c per lb. nickel contained.

Cupro-nickel: 90% or more combined nickel and copper 26.00c per lb. contained nickel, plus 8.00c per lb. contained copper; less than 90% combined nickel and copper 26.00c for contained nickel only.

Monel: No. 1 castings, turnings 15.00c; new clipping 20.00c; soldered sheet 18.00c.

Sheets, Strip . . .

Sheet & Strip Prices, Page 322

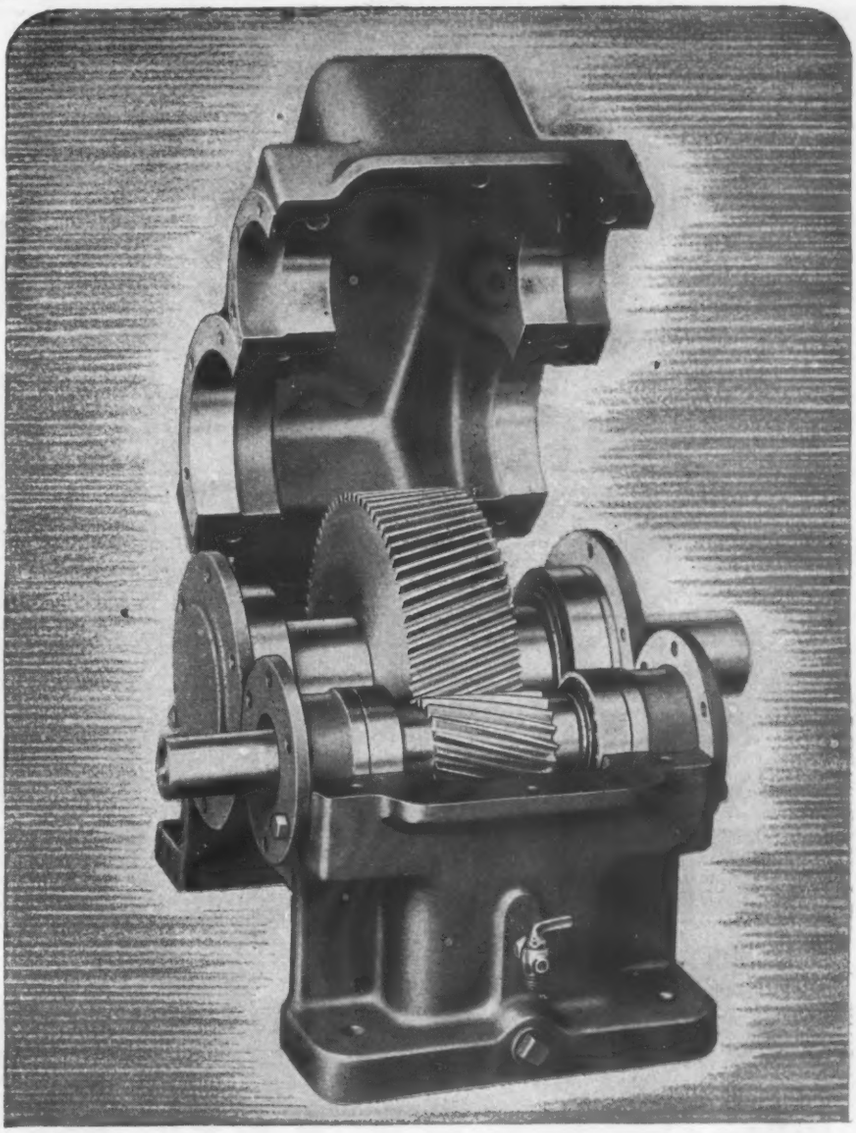
Mill backlogs in sheets continue to increase and in some instances first half production is practically covered. Galvanized sheets are most delayed and some users are turning to painted sheets and black plate. Additional demand is appearing for war programs and manpower shortage promises to make them difficult to meet.

Pittsburgh — As new sheet business continues to pile up, mill backlogs are reaching the point where considerable judgment must be used in scheduling to meet delivery promises. It is certain that not all promised delivery dates can be met, and some less strategic tonnage will be pushed back and possibly canceled in some instances. Both hot and cold-rolled sheets are now booked solidly through second quarter, barring cancellations, and it will be a difficult stretch if the mills, handicapped by manpower problems now as never before, are able to continue production at current peak levels. Galvanized sheet production is already stretching the available facilities and current output is little more than denting the tremendous volume of business scheduled for production as soon as physically possible.

Chicago—New and reinstated war contracts are putting a heavier load on sheetmaking facilities, which already were well in excess of ability to produce. Directives calling for essential tonnages are increasing, and this is largely responsible for creating the tremendous overload. Cold-rolled sheets are in less demand than hot-rolled, and one mill has suggested a reduction in its directive on this item. Galvanized sheets grow more critical from week to week and while idle production facilities could be brought in, lack of manpower is the stumbling block. Reports are heard that production of airplane landing mat is to be reinstated on a substantial scale. This program recently was cut back substantially. If the report proves true, the hot-rolled sheet situation will become even more critical.

New York—While schedules on hot and cold-rolled sheets have shown no recent important change, those on galvanized have been further extended, notwithstanding the fact that buyers of this material are now turning more to painted sheets and black plate. Some producers still have galvanized available for late second quarter shipment; however, most now have nothing to offer before second half and some nothing before fourth quarter. Deliveries on silicon sheets also are extending noticeably. On certain grades deliveries are now in May. This reflects in particular pressure for communications equipment for the armed forces. Hot and cold-rolled sheet deliveries fall principally in May and June although certain producers can still offer April shipments.

Boston—Moderately heavier buying of sheets and narrow cold strip emanates from an increase in war contracts to a larger number of fabricators, warehouses and scattered industrial consumers. Some of the latter have covered late on routine requirements, consequently finding room only in second quarter sheet schedules. Distribution of new war contracts in some cases creates demand for tonnage wanted ahead of regular volume, although most of the latter is for war, directly or indirectly. Tentative orders



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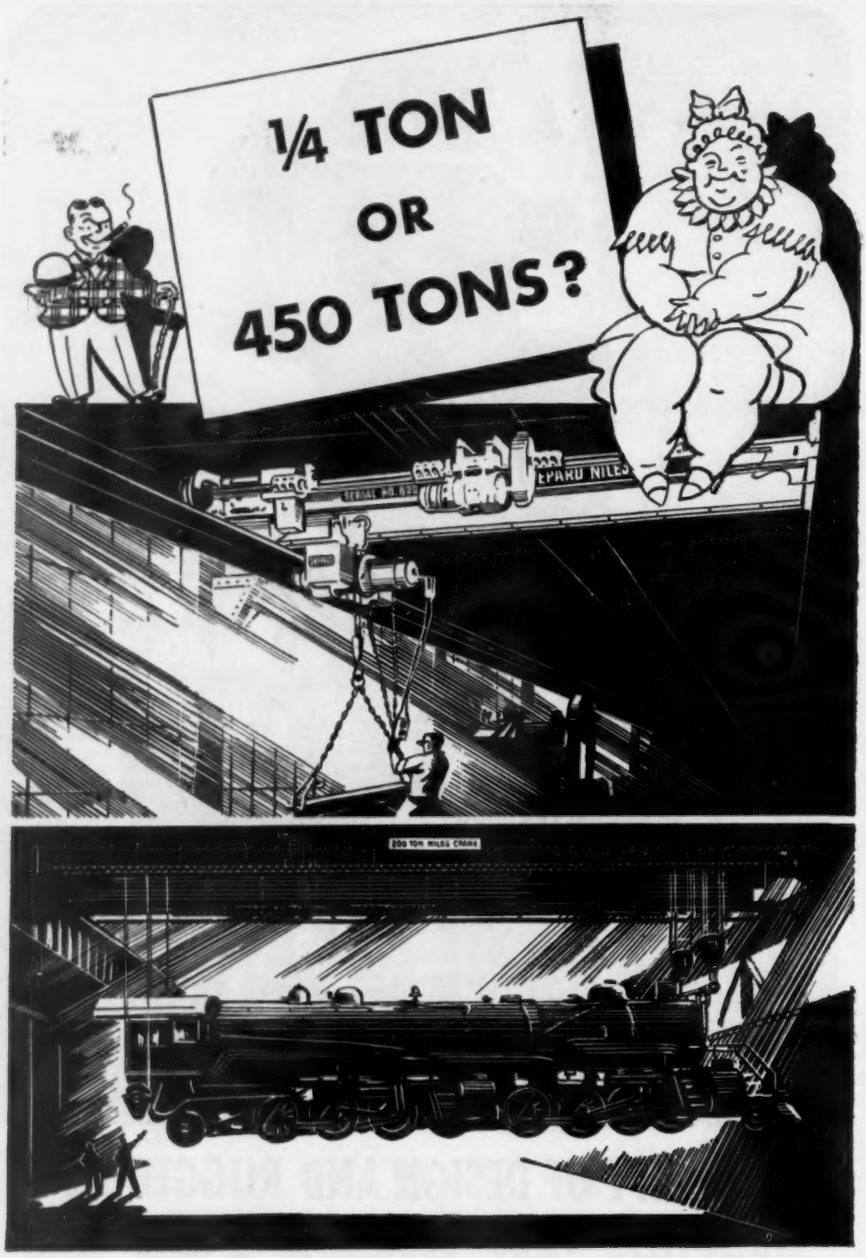

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for potential conversion to usual or new products have practically disappeared. Several large inquiries for sheets, hot and cold-finished, appear for delivery well ahead of current schedules; this also applies to galvanized. Roofing and siding for hundreds of small buildings, warehouses and small structures for a carbon black plant, Oklahoma, calls for large sheet tonnages, the latter being placed by Stone & Webster, Boston. Galvanized sheet production directives are being increased, in some instances possibly 50 per cent, but manpower problems confront some mills in reaching prospective objectives. Increased costs in producing galvanized also would indicate this product be given first consideration in any advance permitted in steel prices. Propeller-type electric fan production for essential hospital, institutional and industrial uses fell short of the estimated 100,000 required last year by about 25 per cent. Manpower shortages and delays in deliveries of materials and components are blamed. Fan production for the same uses is not approved for 1945, but military and shipboard fan requirements will probably exceed 225,000.

Cincinnati — A tighter situation on sheets has developed, due to increased pressure for deliveries rather than intrusion of new demands. Emphasis on military needs, somewhat clouded in recent months by reconversion discussions, tends to extend still further any deliveries against domestic requirements. Mills issued appeals aimed to reduce to a minimum the loss of tonnage to holiday influences, especially on continuous operations and departments which might be bottlenecks.

Cleveland—Sellers report order cancellations in recent weeks have been at the lowest volume in months. This situation, combined with exceptionally heavy demand, has further extended mill deliveries. Some of the more important augmented directives which have pushed sheet and strip rolling schedules well into second quarter, are clips for the small arms program, large steel shell containers, heavy barrels and droppable containers, corrugated culvert sheets, and army field kitchens. Effort to meet larger war requirements has pushed still further into the future any prospect of scheduling civilian goods orders booked during the latter part of 1945. Consumer inventories appear to be again tending upward, reflecting prospect of continued near capacity operations through the winter.

Bars . . .

Bar Prices, Page 322

Mounting demand for the heavy shell program is increasing the load on bar mills and this promises to increase over the next few weeks. Insistent needs of other consumers are subordinated to the war program. It is believed shortage of manpower will cause some other users to cut down actual tonnage they can handle on the present schedule. Many producers now are booked through first half, with other tonnages yet to be placed.

Chicago—While the growing shell program is placing an increasingly heavier strain on bar mills, there is some feeling that a degree of relief may be had from some industries which because of manpower shortage are unable to fabricate bars as rapidly as schedules

call for. As inventories on hand grow, deliveries are likely to be ordered deferred. This is particularly true of the farm implement industry, which is hard beset for labor. Alloy bars are not in as tight a position as carbon, but considerable greater strength is shown here.

New York—Bar schedules are expected to tighten even more rapidly as the new year gets under way. Already various shell manufacturers are well behind on their schedules because of inability to obtain forging and finishing equipment as promptly as desired. But indications are that much of this equipment will be put in operation over the next few weeks, with a resultant further pressure on steel.

Moreover, various new programs for ammunition of one description or another are beginning to shape up and their requirements will be reflected in bar demand for some time to come. Included is a revival in small ammunition schedules. Facilities for this work are available, but as many men were laid off when heavy cutbacks were made some months ago, there is the problem of building these working forces up again, and this is being done.

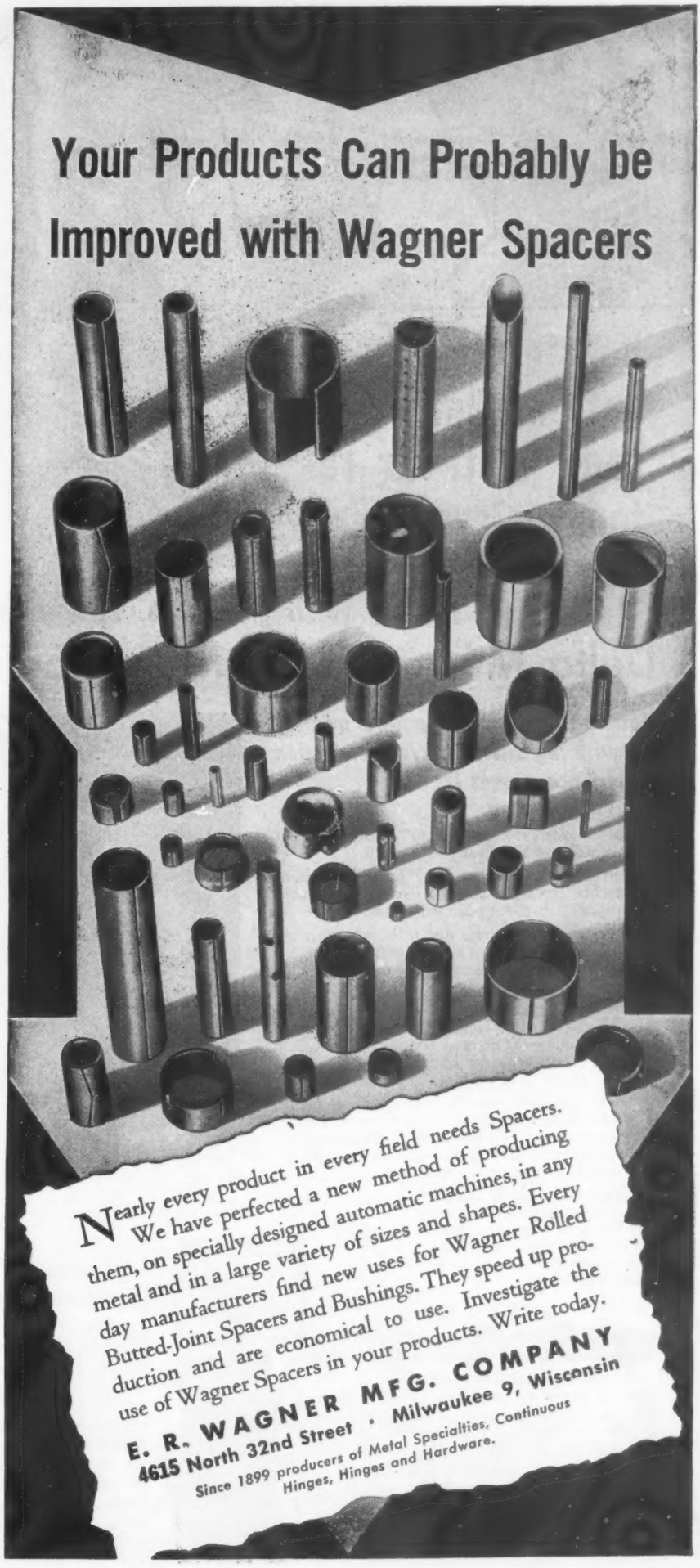
The rocket program also is being delayed by manpower, but in this case especially by lack of highly skilled manpower. Work on this type of munition involves particularly close tolerances and on some of the orders placed over the past fall, rejections have been heavy. However, this situation is being gradually ironed out.

Recently demand for alloy bars has improved. Deliveries can still be had within 30 to 40 days but they are expected to be extended more rapidly from now on.

Pittsburgh—First quarter tonnage now booked by bar producers represents one of the heaviest loads to be produced in a like period. There is no doubt that the tonnage output would be a record if there were sufficient manpower to meet all needs. The weight of the heavy shell program, plus demand for heavy truck parts and aircraft motors has now been augmented by new programs on smaller ammunition. Both hot and cold bars are tight through the first half, if current plans materialize, and there will be trouble supplying the volume of steel specified in directives for that period at the level of the billet mill. Some current shipments are running considerably behind promised dates, although in some mills, schedules are being met regularly.

Boston — Steel orders to meet increased war requirements are especially reflected in heavier bar demand, both carbon and alloy. While steel for heavy artillery is a major factor in lengthening deliveries on more sizes in hot-topped quality grades, inquiries for other miscellaneous contracts, including rockets and launchers, small arms and various ordnance components, are initial contributors to stronger buying in this area. Production of artillery ammunition is to expand with the entrance of United Shoe Machinery Corp. at Lowell, Mass.; Babcock Printing Press Corp., New London, Conn., and Petroleum Heat & Power Co., Stamford, Conn., will get additional highly skilled men released from the army. Both are making 8-inch shells. Another shell shop, at Fitchburg, Mass., will also increase.

Forge shop requirements are heavier; most have brought up schedules to the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limit of manpower. Military production at small arms ammunition plants, cut back early last year, is being restored as fast as manpower is available. Buying has broadened materially, emanating in some instances from consumers who have been placing limited tonnage. Mill placements by warehouses are also heavier. Antifriction bearing industry for some time will be a good consumer of alloy grade. Supply of bearings has eased materially from earlier critical periods. Some sizes are still tight, notably in the 53-mm. to 100-mm. range, required in large quantities by military equipment. Overall shipments have been slightly ahead of orders. Cutbacks and production readjustments up to now have been greater in small bearings, but trend in the war may reverse this shortly.

Cleveland—Delivery pressure for both carbon and alloy steel bars is steadily increasing as directive tonnage for the augmented small arms and ammunition, aircraft parts, heavy trucks, radar, and machine tool programs is forced on mills already overcrowded production schedules. Sellers had the largest carry over tonnage in months as January operations got under way, and this situation is expected to grow more acute in the weeks immediately ahead. Forge shops and cold-drawers are particularly busy at this time, in the latter instance deliveries are extended in May on the larger sizes. The heavy ammunition program is the chief factor in extended carbon bar delivery schedules.

Plates . . .

Plate Prices, Page 323

Boston — Placement of orders is delayed in some instances by shipbuilders screening their own and other inventories for surplus steel to round out requirements for remainder of current contracts. Purchase of material for six small tankers by a Boston district yard will be less than expected and postponed to later this quarter. Relatively little mill tonnage will be needed. Shipyards and subcontracts are not only taking smaller tonnage but are shaking out inventories where possible; this applies especially to those approaching completion of current contracts. Increased 1945 pontoon program, lifted to 60,000 tons, mainly plates, bringing the total to about 160,000 tons, stresses deliveries and fabricating will be concentrated heavily in first quarter with directives on considerable steel required. Most of increase, however, will affect shops in other areas more than in this. Most fabricators experienced in pontoon assembly are retained, with one at least added.

Never a large consumer of steel, although constructing 100 small boats for the navy during this war, Herreshoff Mfg. Co. yard, Bristol, R. I., builder of several famous America cup defenders to meet challenges of Sir Thomas Lipton and T. O. M. Sopwith, is being dismantled. Millions spent in vain by Sir Tom and T. O. M. to lift the famous mug, will not be forthcoming after the war. Racing of big sloops costs big money, too big now for most in this country. They made good business for Herreshoff in other, and maybe better, years. Now with government contracts completed, materials not available for civilian craft, there is no work and buildings are coming down. At this yard, the first duralumin mast was stepped in a racing yacht, and, while never a heavy fabri-

cator of steel, the Herreshoffs developed some interesting and new maritime uses.

Pittsburgh — Current plate bookings continue slightly less than shipments. Backlogs are still declining, but in the opinion of some producers the minimum level has just about been reached and equilibrium on about the present basis will be established. While current orders are substantially less than the peak, there is sufficient tonnage to keep the plate mills well occupied, but not enough to require more than a small part of the sheet mill capacity. Undoubtedly some of the continuous stripsheet mills which have been converted on a "permanent" basis—that is, with equipment so fixed that either plates or sheets can be rolled at will and on the same basis, will continue to accept orders for light plate in economical widths. However, sheets are again the first consideration on these mills.

Chicago—Although plate load is not as heavy as it was early last year, it is increasing again. While some new shipbuilding is planned, the program should not put too severe a demand on plates in the next few weeks. However, miscellaneous construction is taking up some of the slack. As a matter of fact, some mills believe their January directive can be pared down significantly. Tank manufacturers continue busy and have sizeable backlogs for small storage tanks. Lack of WPB allocation for small storage tanks has enabled one mill in the district to sell some excess prime plates into this field.

Cleveland—Pressure for prompt plate deliveries is stronger than was thought likely 30 days ago; in a few instances sellers report a reversal of the downward trend in orders. Stiffening in demand is expected by most to be only temporary, with the continuation of the downward trend likely to be resumed early in February. Mill deliveries are still available for late February. On the basis of current orders and backlogs plate output for first quarter will be moderately below that for fourth quarter.

Wire . . .

Wire Prices, Page 323

Wire mills are carrying as heavy a load as at any time since the war laid its demands, civilian requirements being crowded back by insistent need for use by the services. Estimates of 1944 production rank it second only to 1941, when the peak was reached. Agricultural implement needs to meet demand from the South, where earlier spring leads the seasons, is heavy. Welding wire is in strong demand. Small ammunition programs calls for much wire for bullet cores.

Chicago—Wire jobbers are experiencing extremely strong demand for merchant products, particularly nails. Stocks are reported to be the lowest in history and prospects for replenishment are not bright under the present accelerated war load. The increased small ammunition program has developed substantial orders for bullet core steel and tonnage for this is now about the same as obtained several months ago. There is heavy pressure for farm implement spring stock and grain drill material for use in equipment which must be made available in the southern area, which has an early spring. Demand for welding wire has come back strongly and requirements can not be

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fully met. One local wiremaker has been asked to book more orders than its capacity in first half. Requirements for electric wire and cable are not as strong as early last year, and orders for wire mesh are tapering somewhat.

Boston—Wire mills enter 1945 with schedules as overcrowded as at any time since war began. Upward trend in bookings continues, with war requirements displacing other volume of importance; supply of drawn wire in more sizes is tightening. Directives firming most urgent orders in revised production schedules are frequently necessary. For more normal uses, wire is sharply restricted, but needs for the services, including a multiplicity of specialties, overshadows curtailments. Expanding placements cover not only increasing volume sought for rope and signal wire, which have been heavy for many months, but are also broadening to take in additional high carbon sizes and grades, a large number of which require long and fixed processing. Most equipment for this is already overloaded.

Production of wire rods, iron and steel, is estimated at 4,994,000 tons in 1944, under the 1941 peak, when 5,268,423 tons were produced; 1943 output was 4,693,798 tons. Drawn wire production, estimated at 3,965,000 tons, surpassed 3,718,356 tons, 1943, but was slightly below the 4,022,590 tons in 1941. Breakdown in drawn wire consumption indicates continuation of an uneven load, supply for most war uses being abnormally large, while for numerous less essential goods volume is down; an example is about 2550 tons for keys and handles for packer cans last year, below normal because of restrictions on use. Applied to a large number of peacetime products curtailment in wire for civilian use involves a large tonnage of drawn and finished wire.

New York — Signal wire placements have been increased by directive and quotas raised. Rope wire, one of the most critical, fills capacity and producers can add no further tonnage to schedules except at expense of other essential items. Demand for tire bead wire reflects increase in the military tire program, notably in three sizes, .025, .037 and .043. Rope and tire wire falling largely in the same size ranges, drawn material for other use is pinched. Spring wire for small arms is more active, also music wire, displacing some previously booked volume. Continuing directives, increased in some cases, are accompanied by more spot directives establishing firm place on schedules which are undergoing a wave of revisions. Enlarged quota for .013 galvanized signal wire is reported to be close to 600 tons a month higher than best yet attained by the industry. Increase in demand for wire is wider spread and deliveries are more extended on volume not protected in schedules. While some sizes of rods may be obtained in April, others have moved into May.

Pittsburgh—Now that initial market reactions to the granting of higher wire prices to Pittsburgh Steel Co. have been received and analyzed, it seems safe to predict that demand for finished wire products in the merchant market will not be affected by such increases. It is probable that the higher prices on semi-finished items will act as a deterrent to converting mills, but as far as the ultimate markets are concerned, this preliminary testing will prove beneficial in

getting the price of such products raised to reasonable levels. Last price increases on wire products date back to prewar days, and the margin on merchant items has been so small that at least part of the shortage can be attributed to that factor. Demand continues high, as always, for all types of merchant wire products. There is a fairly heavy volume of demand for manufacturers wire in all categories, with the accent still on the small diameter products.

Tin Plate . . .

Tin Plate Prices, Page 323

Pittsburgh — Tightening of the sheet situation generally may have some effect on the first quarter augmented tin plate schedule. While a substantial part of the cold-rolled black plate for the program has already been set aside, and mill stocks are bulging, it is possible the latter end may be pinched and there is certain trouble ahead for second quarter if increases are scheduled in line with the first quarter increase. What is more likely to happen is a delay in relaxation of M-81 which would call for additional uses of thin-tinned electrolytic plate. Such delay would reduce the anticipated tin plate demand and keep production about on 1944 levels. The revision in M-81 is almost certain to be held up until the whole sheet schedule for first quarter can be completed, and possibly until some definite idea on second quarter can be obtained.

Rails, Cars . . .

Track Material Prices, Page 323

New York—Preliminary estimates of freight cars placed by domestic carriers in 1944 indicate an increase over last year of approximately 7000 cars, the annual total amounting to around 48,500, as against 41,335 in 1943. Bookings also compare with 26,028 in 1942 and 121,499 in 1941, the year before the war emergency became acute, and restrictions were placed on car construction.

In view of the increasing emphasis on war munitions, it is regarded as probable that production schedules against equipment now on order may be slowed. December witnessed placing of more than 11,000 cars, which was the heaviest total since February when 13,240 were placed. But with the reverses now taking place along the western front and the increased need for munition replacements, construction of this equipment will not only proceed at a slower pace than anticipated, it is believed, but new orders from now on may taper rapidly. Incidentally, one bottleneck in the car program is wheels. Builders in placing orders recently reported that about the best they could do on wheels was July.

Recent outright cancellations in the Army program for 24,600 cars for export are expected to have little effect on the domestic program in view of requirements which are developing in other directions.

Pittsburgh—With the army car program again up in the air as a result of cancellations on previously outlined 1944-45 programs, and the steel supply considerably less hopeful than it was 60 days ago, carbuilders are still wondering what to do about 1945. The domestic roads have finally whipped into shape a carbuilding program which at present seems substantial, despite a late start.

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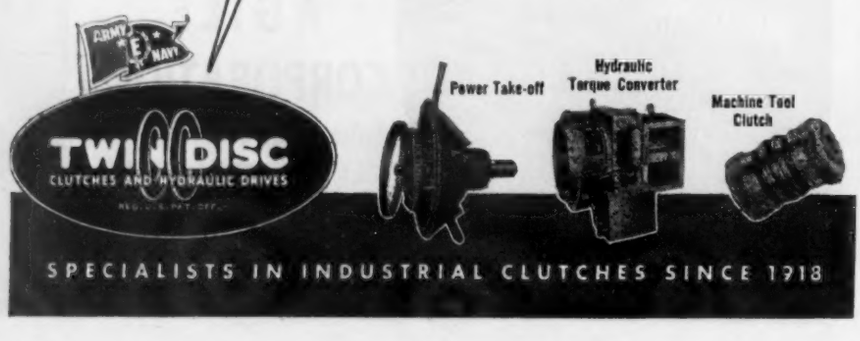

However, there may not be sufficient wheels to put under the cars, even if there is steel enough to build the bodies and enough auxiliary equipment. Army cancellations may or may not be permanent. Reinstatement of these orders will undoubtedly cause a change in the domestic program as now outlined, and push back delivery promises in all but a few instances. The rail situation has again been upset by heavy shell demand, which has placed heavy round tonnages on rail mills and cut down available production time considerably for first and second quarters.

Structural Shapes . . .

Structural Shape Prices, Page 323

Chicago—Orders for fabricated structural steel are at low ebb, and inquiries have fallen off to almost nothing in this district. It appears that construction of new plants and additions to accommodate war production has reached an end, and that the accelerated armament production is forcing shelving of some preconversion construction that has been under contemplation recently. Meanwhile, demand for plain shapes required for miscellaneous military construction and ships is extremely heavy and mills are booked through first quarter. Essential tonnages needed quickly can be had only by directive.

New York—November bookings of fabricated structural steel for bridge and building construction reported to the American Institute of Steel Construction by companies representing 75.5 per cent of the total average of the industry during 1923-25, totaled 59,150 tons, compared with 76,709 tons in October and 34,093 tons in November, 1943. Reported shipments in November totaled 47,365 tons, compared with 42,741 tons in November, 1943. Reported tonnage available for fabrication at Nov. 30 was 184,239 tons.

Cleveland—Mill deliveries on structurals have tended to lengthen in recent weeks, with shipments now generally promised for March delivery. Pending structural jobs here include: 180 tons, Fairmount pumping station, for the city and 600 tons Republic Steel Corp.'s strip mill expansion. Bids on the Clark avenue bridge, for the city, have been thrown out, and this job is not expected up again for bids until the middle of January. Vogt & Conant, Cleveland, were recently awarded 450 tons for an addition to National Supply Co.'s diesel engine plant at Springfield, O. Structural fabricators report a fairly large order backlog, composed mostly of jobs involving well under 100 tons.

Boston—Heaviest structural sections required for a New England industrial building in recent years will be fabricated by Bethlehem Steel Co. for the magnesium press plant, Wyman-Gordon Products Corp., subsidiary of Wyman-Gordon Co., Worcester, at Millbury Junction, Mass., to house an 18,000-ton capacity press; weight of steel will be close to 47 pounds per square foot of building space and will include 36-inch crane beams. Press, largest of its type ever assembled, will be built by Mesta Machine Co., Pittsburgh. Active inquiry as the year opens is light, mainly small industrial projects under 50 tons each. Sharing in award of close to 3000 for surplus material warehouses, placed with seven fabricators, is a Providence district shop

which has been active in pontoon angle assemblies; several hundred light steel-framed structures are included in this contract. Shipyard subcontract backlogs are lower; some shops have completed this volume without replacements in sight and are seeking work, although a few fabricators are active on construction orders. Buying of plain material is slower with mill schedules for March delivery filled on more sizes with some in April.

Outstanding is approximately 950 tons for two hospitals at Burlington, Vt., and Rocky Hill, Conn. Structural buying by warehouses has slackened, confined largely to spot demand. Mills are in March on most sizes; effect of the shell steel program contributes to the tightness on some units. Among the more active shops are those at Holyoke, Mass., Berlin, Conn. and Bridgeport, the latter on subcontracts for Brooklyn navy yard.

Reinforcing Bars . . .

Reinforcing Bar Prices, Page 323

Chicago—In face of the expanded program for production of military goods, activity of reinforcing steel appears to be suffering. Orders for bars and related items, as well as inquiry, are negligible. There is feeling that certain pre-reconversion construction under contemplation recently, as well as highway bridges, flood control, and other work, will have to be put aside in view of the tight steel supply.

Pig Iron . . .

Pig Iron Prices, Page 325

Pig iron is quiet as the new year is entered, foundry demand still held down by lack of workers, while castings contracts are offered in profusion. Some relief is being afforded in spots but it is not sufficient to take care of the shortage. Little holiday interruption was permitted this winter and production was kept as high as possible. Shortage of cast scrap has caused larger proportionate use of pig iron in foundry mixture but this has not been a large factor.

Cleveland—With four of the 14 blast furnaces in the Cleveland-Lorain district on merchant iron, production of iron for sale is currently at the highest level in months. All of the 14 furnaces are pouring iron. Overall pig iron production and consumption is in delicate balance with neither blast furnace interests or consumers able to augment stocks to any extent. Most foundries have about a 60-day inventory. Should the tight manpower situation ease to the point where a substantial increase in foundry operations would be permitted there could develop a pig iron shortage unless some of the high cost units, now idle, were quickly brought into service. Most of the pig iron consumers in this area have contracted for first quarter delivery. A moderate increase in consumption is indicated for this period on the basis of the slightly heavier bookings compared with fourth quarter. Foundries serving machine tool builders report an upturn in demand, and on the basis of the recent augmented machine tool requirements, these foundries expect to operate at the level permitted by the manpower situation for some months to come.

New York—Pig iron consumption is expected to expand not only because of

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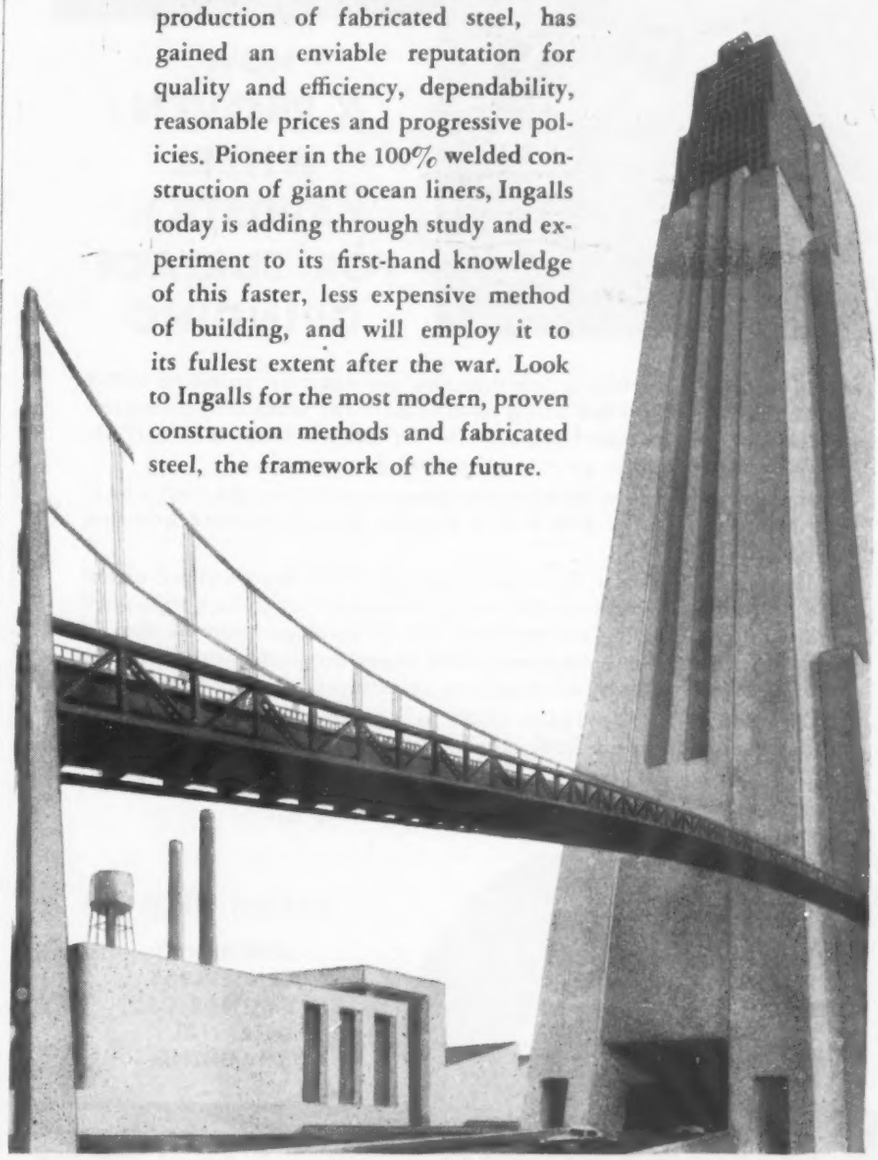

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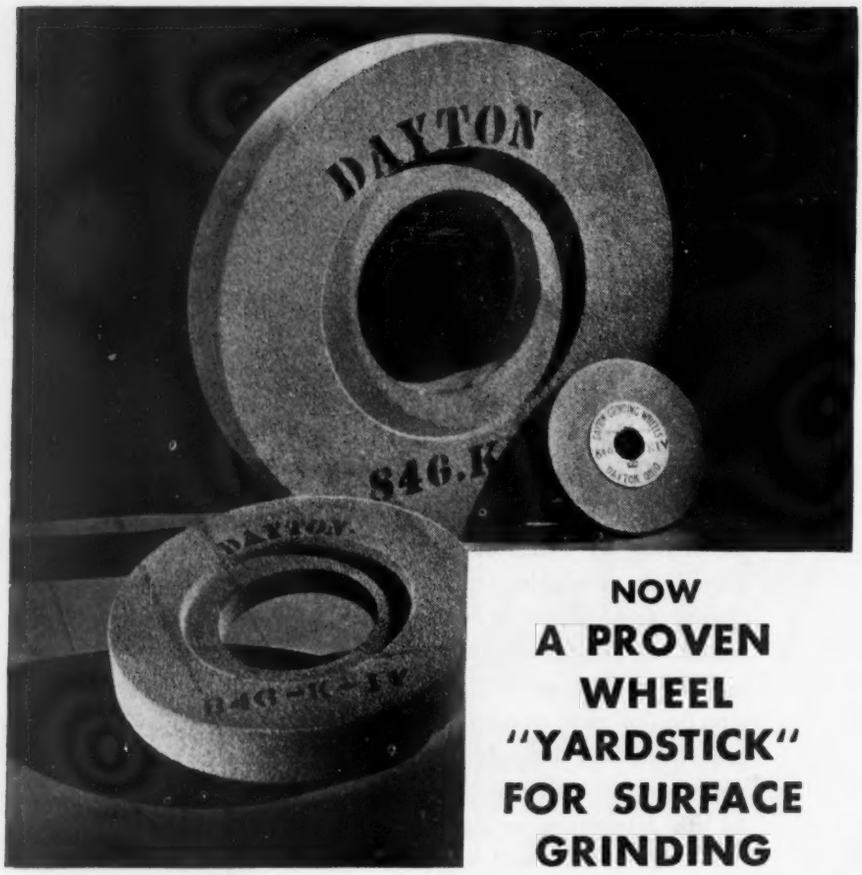

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DAYTON GRINDING WHEELS

heavy pressure on melters, but also because of continued shortage of cast scrap. District foundries are having to rely more and more on pig iron, because of difficulty in getting cast material, and there is no improvement in the outlook for cast scrap as demolition operations continue at low ebb and will likely remain so for a while.

Manpower remains a bottleneck, but a betterment in this situation is expected, as measures now being taken to channel workers into spots where they are most needed become more effective. There is no overall shortage of labor, it is pointed out; it is the problem of directing supply to plants where war needs are most urgent, and such plants include foundries.

Chicago—Some increase in demand for pig iron is noted in this district, in spite of the fact that manpower has been the controlling factor in tonnage the foundry industry could consume. Contributing to the shortage of merchant iron has been the blowing out of Youngstown Sheet & Tube Co.'s No. 3 South Chicago blast furnace Nov. 1, for relining. This stack resumed Dec. 19 and will ease the situation. Currently, 38 of the district's furnaces are active. Because of the critical manpower situation in foundries, the Army is releasing soldiers to go into foundry work. A total of 113 have been released from Fort Sheridan to work in 23 foundries in Illinois, Wisconsin and Michigan. While a help, this is only a drop in the bucket; some foundries could use the entire number and still be needing more.

Cincinnati—The pig iron market is quiet, following contracting by most melters for first quarter requirements. Almost all buying was done through regular sources of supply, and displayed optimism that somehow the melt might be expanded. As heretofore, manpower shortage is the bottleneck. Foundries held holiday shutdowns to a minimum and there was no excessive loss of tonnage.

Boston—Pig iron shipments to New England melters, estimated around 23,500 tons a month, have held close to that tonnage for an extended period; basic averaging near 15,000 tons a month, most moving via Buffalo, this is abnormally high in relation to foundry grades, due primarily to manpower shortages in foundries, improving but slightly. Total melt last year approximated 280,000 tons, with the ratio of basic to foundry roughly in proportion to current monthly production, although there are frequently more changes in sources of supply. Most large melters, notably in the textile mill equipment industry, are operating foundries under 50 per cent of capacity. While subcontracting spreads distribution, a substantial gap in aggregate capacity exists, despite the fact some shops are operating to limit of manpower. Consumption by the Everett cast pipe foundry has been negligible for months, probably affecting near 5000 tons in last year's total melt. Supplies with merchant furnaces are generally lower. Around 5000 tons a month is withdrawn from the Mystic reserve; that producer is down until spring at least. Buying against first quarter needs is lagging slightly, but total melt for the period will probably be maintained. Machine tool builders are enlarging sources for gray iron castings in some instances.

Scrap . . .

Scrap Prices, Page 326

Scrap prices have returned to ceilings, except for a few grades, including borings and turnings, and on these prices are higher. While there is no scarcity supplies are not excessive and most steelmakers are taking all offerings at top prices. Snow is hampering collection and preparation somewhat. The general situation is firm.

Pittsburgh—Continued bad weather, plus year end factors and the holidays have combined to reduce scrap flow here to a trickle from usual market sources. Some industrial material is available. All buying is now back at ceiling levels, as far as openhearth grades are concerned. However, the turnings market still resists higher prices and is steady at quoted levels. Buying is light, as is normal for the year end period. Some small sales have been made for January delivery, and prices on continuing contracts through January are all at ceiling levels except on turnings. Railroad lists closing in the first week of January will probably come into this district at ceiling on all grades offered, with virtually all mills accepting tonnage.

Chicago—Scrap prices are unchanged at year end, with all openhearth and cast grades at ceiling. Few consumer sales are being made and a good test of the market is still to come. Heavy snows interfere with operations in scrap yards, but dealer scrap is contributing only a small part of total material moving. Principal activity in this district is dealer-broker transactions, as the latter attempt to fulfill commitments on old orders.

New York—Demand for heavy melting steel and cast grades is strong. Machine shop turnings and mixed borings and turnings also are under greater pressure, with brokers now paying $9.50. These grades are among the few not yet at full ceiling levels.

Philadelphia—Prices of scrap are unchanged with turnings and mixed borings still at $13 to $13.50, delivered at consumer's plant. Most other grades, except billet and forge crops are at ceiling. General demand is strong.

Cincinnati—The stronger trend in the iron and steel scrap market is being maintained even though some district mills show no immediate interest in further commitments. The recent tonnage sale of heavy steel may be the forerunner of ceiling prices again for the entire list. Prices are strong as dealers seek to cover contracts, but less interest is shown in light grades.

Boston — Recovery of steelmaking grades to ceiling levels has focused interest in scrap, tending to obscure or minimize growing tightness in supply of foundry grades. This has reached a point some consumers suggest allocations, although inventories vary, with several larger consumers comfortably fixed. Limited supply of cast is such allocations might well mean taking scrap from one melter to meet needs of another. Melt of steel scrap is slightly heavier with foundries striving to conserve cast, but heavier melt of pig iron for the same reason is retarded by cost differentials. Led by short shoveling turnings, lighter grades of melting steel, machine shop and mixed borings and turnings, display additional strength;

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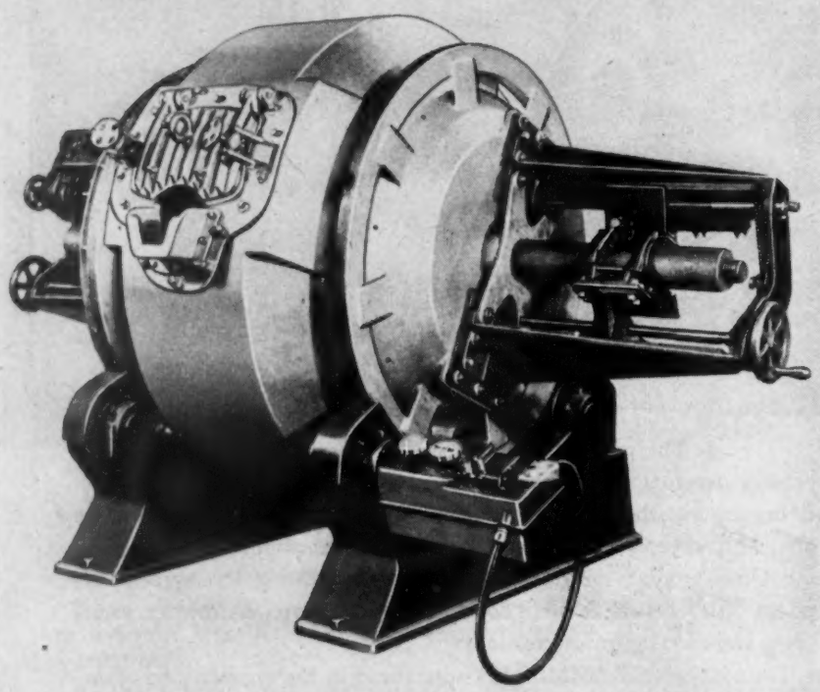

man-hour. They produce as many as 8 ferrous or 16 non-ferrous heats in one eight-hour day. Because of their precise metallurgical and operating control, Detroit furnaces assure quality results and maximum economy.

Detroit Electric Furnaces are versatile, flexible and fast. Since melting takes place in a closed chamber, dirt and fumes are reduced to a minimum. Available in seven sizes with capacities from 10 to 8,000 lbs.

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chemical borings meeting specification command ceiling prices, although one large consumer is living off inventory and a second has halved recent buying. Most production, however, is absorbed. Short shoveling turnings have been sold at $15, delivered Eastern Pennsylvania, with rumors of higher prices.

On most steelmaking scrap, dealer offerings are limited, but bids on unprepared material are stronger. Government shop and shipyard sales are more frequent, one at the Boston navy yard, Dec. 29, including among numerous classifications 500 tons of unprepared heavy melting. Although alloy scrap, including solids, is not displaying the strength of carbon grades, there are minor instances of firmer prices. No. 2 bundles are recovering slower, with some resistance on the part of consumers to a return to former level, but New England prices are generally back to normal ratio with other centers. Largest consumer in this area is buying steadily and accepting shipyard scrap against old orders, but Pennsylvania melters take a good portion of shipments. Inventory at Worcester is comfortable and well balanced as to grades.

Cleveland—Prices on all grades are again at ceiling, reflecting small purchases of open-hearth and blast-furnace items here, but to a greater extent heavy shipments from this area into the Youngstown and Sharon, Pa., districts. Unusually severe winter weather has impeded movement of scrap into consuming channels and this situation has been further accentuated by the tight manpower problem. Leading scrap users here still have adequate supplies, but should the restricted movement through dealers' yards continue and present near-capacity operations be sustained through the winter, there is a good possibility that a scrap shortage may develop. However, some mills continue out of the market, contending that commitments and inventories are adequate. Demand for cast scrap grades remains strong, while the supply situation has lately become more serious.

St. Louis — The scrap iron market in the St. Louis industrial district is quiet, due to the holidays, but strong. The extremely cold weather continues to hamper the gathering and processing of material, and receipts have been light as a result. Prices are unchanged.

Warehouse . . .

Warehouse Prices, Page 324

Chicago—Warehouses are feeling pressure from the stepped-up war production program. Not only are orders and inquiries increasing, but quantities of steel required frequently go well above customary warehouse sizes. Thus far receipts of steel from mills are regular, but from this point on, the flow may become irregular. If this happens, stocks will become even more unbalanced. Many sizes and specifications already are in short supply and substitution frequently is mandatory.

Cincinnati — Warehouse sales tapered as a result of holidays and desire of some consumers to reduce inventory at the year end. Demand earlier in the month, however, was heavy and jobbers consider the lull temporary. Three-day shutdowns for the holiday were numerous. Stocks are heavier than a year ago although out of balance in the more active items.

Cleveland—Although daily average shipment out of steel distributors' stocks in December was somewhat below the best rate last year, during October, the yearend seasonal decline was considerably less than in previous years. Warehouse interests continue to have difficulty filling orders for prompt shipment, particularly on items requiring cutting and shearing operations. Distributors state a considerable portion of their orders on mills' books for sheets, bars and structurals, formerly scheduled for December and January delivery, have been pushed back one month, and there is a strong indication that the situation will grow more critical in the weeks immediately ahead. At present warehouse interests are selling more than is being shipped them by the mills. This is in direct contrast with the aims of the relatively recent revision to order M-21-b-1 authorizing distributors of general steel products to place orders for delivery in first and second quarters up to 25 per cent in excess of shipment from stock in order to build up inventories.

Nonferous Metals . . .

Nonferrous Prices, Page 328

New York—To meet requirements for small arms ammunition, artillery shells and other heavier war programs, demand for copper and copper-base alloys, notably brass, will reach former wartime peaks if manpower is available in channels of production from mines to fabricating plants. Manpower will be the dominating factor in this upsurge; mills and fabricators are striving to rebuild operating forces weakened during cutbacks of last year. The bulge will be especially acute in brass strip production, which is being increased sharply by every available means. Stockpile of copper, which has been growing moderately during recent months, will probably be reduced some during the next few months. To meet heavier loads, supply seems to be adequate, but an intensification of restrictions and controls in conservation policy is reflected in the halting of Z-1 allocations and other tightening in use.

Total consumption, 1945, is estimated at around 1,650,000 tons, about 50,000 tons under the 1943 peak. Refinery output of 1,105,200 tons is indicated, pending official data.

Review of CMP allotments for first quarter reduces civilian tonnage to a minimum, with withdrawal of some spot authorizations formerly approved. Brass strip production goals are fixed at an average of 177,000 tons a month; Canadian steel mills and other facilities will be utilized, also copper-clad steel for the production of ammunition strip; brass mills on the national production urgency list will get priorities on manpower. Other brass mills products will be affected sharply by the increased demand, including rod and tube mills, but the load is likely to be heaviest on strip.

Lead supply is also becoming tighter. A limitation order to regulate consumption is invoked, reducing use in nonessential products. Zinc requirements are also rising for both brass and galvanizing. Zinc supply, however, is comfortable and can readily meet any increase in consumption in sight. While production of primary aluminum has been sharply curtailed.

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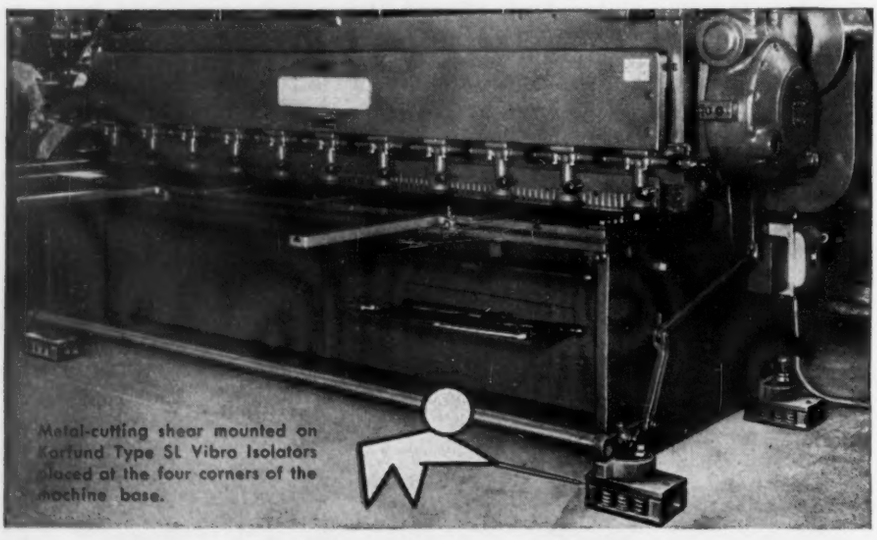

Metal-cutting shear mounted on Korfund Type SL Vibro Isolators placed at the four corners of the machine base.

STRUCTURAL SHAPES . . .

STRUCTURALS PLACED

700 tons, bridge repairs, various locations, for Chicago, Rock Island & Pacific railroad, Chicago, to Vierling Steel Works, Chicago.

148 tons, two twin-deck spans, Elberon, Iowa, for Chicago, Milwaukee, St. Paul & Pacific railroad, to American Bridge Co., Pittsburgh.

127 tons, two beam groups, Evanston, Ill., for Chicago, Milwaukee, St. Paul & Pacific railroad, to Wisconsin Bridge & Iron Co., Milwaukee.

100 tons or more, one 50-ton portal crane, Mare Island navy yard, Calif., Bureau of Yards and Docks, Navy Department, to Star Iron & Steel Co., Tacoma, Wash., $256,000, spec. 15370; other crane contracts: five-ton bridge cranes, naval dry docks, Hunters Point, Calif., to Cyclops Iron Works, San Francisco, $29,031, spec. 15329.

STRUCTURALS PENDING

550 tons, factory additions, buildings 34A and B, for Chrysler Corp., Detroit.

475 tons, manufacturing building No. 12, Plymouth plant, Chrysler Corp., Detroit.

325 tons, 200-foot through-truss railroad span, Alaska, for U. S. Department of Interior.

REINFORCING BARS . . .

REINFORCING STEEL PLACED

530 tons, paving and three reinforced concrete bridges, Lebanon county R-140 (1-E), R-141 (L), East Hanover, Union and Swatara townships, Pennsylvania, to Bethlehem Steel Co., Bethlehem, Pa., through Potts & Callahan, contractors.

221 tons, state highway project, SN-FAP-32A (4), and SN-FAP-32-E (1), Phillipsburg, N. J., to Bethlehem Steel Co., Bethlehem, Pa., through Fred Berlanti & Son, Harrison, N. Y., contractor.

211 tons, paving and concrete bridge, Lebanon county R-140 (1-G) Sec. 1, East Hanover township, Pennsylvania, to Bethlehem Steel Co., Bethlehem, Pa., through Potts & Callahan, contractor.

200 tons, manufacturing plant, Reynolds Moulded Metal Plastics division, Continental Can Co., Cambridge, O., to Truscon Steel Co., Youngstown, O., through Sordoni Construction Co., contractor.

REINFORCING STEEL PENDING

200 tons, Liberty road-Montebello tunnel, Baltimore, bids Dec. 22.

200 tons, plant expansion, Panther-Panco Rubber Co., Chelsea, Mass.

150 tons, research and development laboratory, U. S. Bureau of Mines, Bruceton, Pa.

PIPE . . .

CAST PIPE PENDING

376 tons, 8 and 16-inch, Hartford, Conn.; Warren Pipe Co., Everett, Mass., low.

Commercial Truck Programs Authorize Larger Output

Commercial motor truck programs for all types of trucks, as announced by the War Production Board for 1945, authorized a higher level of production as compared with 1944 figures with the exception of light trucks, for which there was no production schedule last year, and heavy-heavy off-highway trucks.

Aluminum Plants Closed as Output Exceeds Demand

Production still is three times prewar peak. Light metal is being substituted for more critical materials

THE ALUMINUM industry in 1944 went far enough "over the top" in supplying war needs of the United States and its allies to permit the War Production Board to close down entirely a number of government-owned aluminum plants, releasing thousands of workers to shell-producing plants and other critical industries which need them badly for the final, all-out victory drive, states I. W. Wilson, vice president in charge of operations, Aluminum Co. of America, Pittsburgh, in a yearend statement.

"Even with substantial concurrent reduction in Alcoa's production, aluminum is still being made in this country at a rate three times that of the peacetime peak," said Mr. Wilson. "During 1944, ever-increasing quantities of the metal poured into new military applications. Because of its availability, aluminum was not only returned to those military uses for which other materials had been substituted, but was, itself, substituted in many cases for other materials less plentiful in supply. The new year should see growing amounts of aluminum going into the semimilitary and civilian uses which must be expanded as rapidly as manpower may be safely diverted to their development.

Surpluses Utilized

"Wherever possible, surplus aluminum stock left in military stores, has been utilized.

"Aluminum manufacturers during 1944 developed a number of new alloys of military importance and of far-reaching peacetime significance. A new Alcoa alloy, 75S, has a yield strength about twice that of the strong aluminum alloys used only a few years ago, and an ultimate strength exceeding 80,000 pounds per square inch.

"To help offset the shortage of high-grade domestic ores for the production of aluminum, Aluminum Co. of America research laboratories completed and put into commercial operation a process which successfully uses a much lower grade ore (See STEEL Dec. 25, p. 47).

"To meet urgent civilian demands for aluminum, WPB issued during the latter half of 1944, a series of authorizations for the use of the metal in cases where manpower would not be taken from essential war work and where other more critical materials could be replaced.

"Although military demands for aluminum continue to create a manpower

MODERN industry is full of jobs that are "too hot to handle"—applications at high temperature levels, which often burn out ordinary connections not built to take extreme heat. But REX-WELD works efficiently at temperatures up to 1,000° F. and burst pressures up to 11,000 p.s.i. Result: fewer delays . . . lower maintenance costs.

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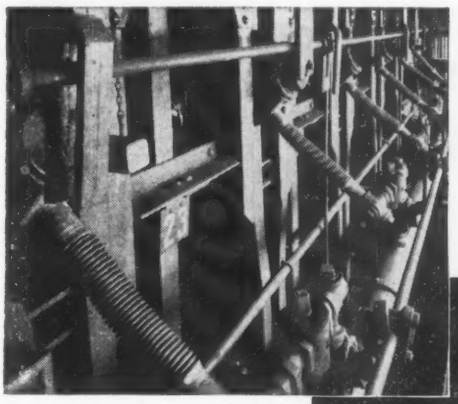

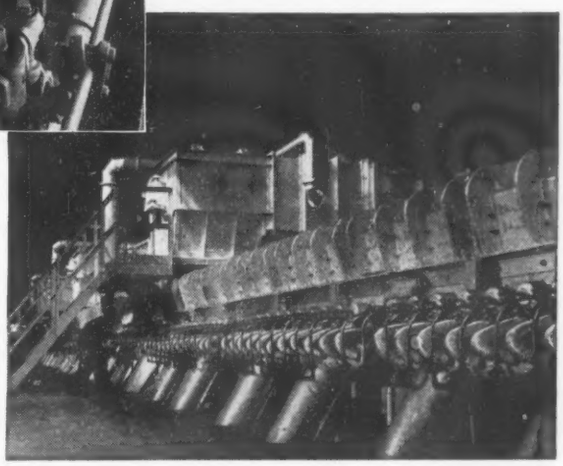

(At Top) Rex-Weld Equalizer connections on annealing furnace. (Above) Rex-Weld conveying coke oven gas.

Rex-Weld type RW-80 on pipe welding furnace.

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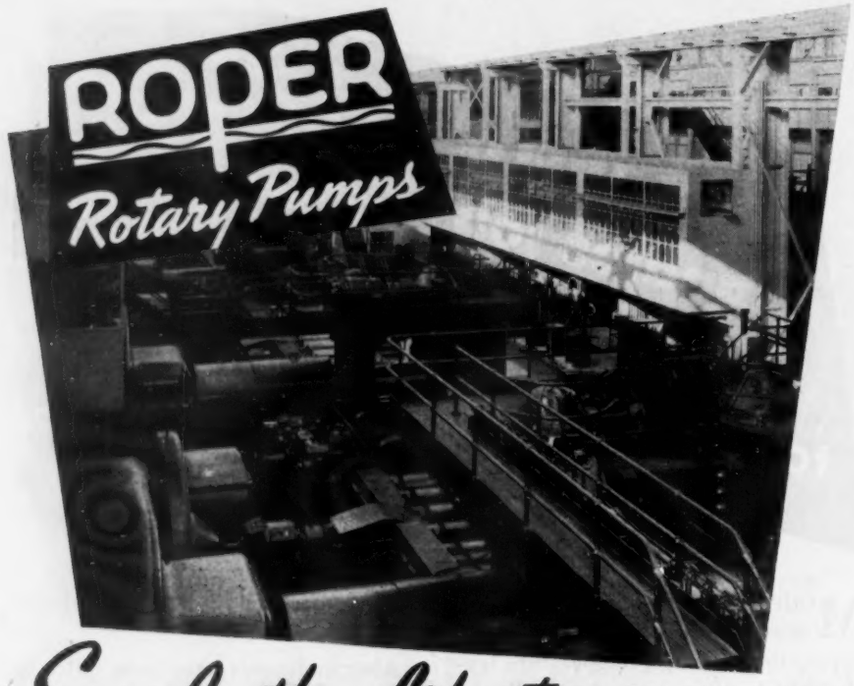

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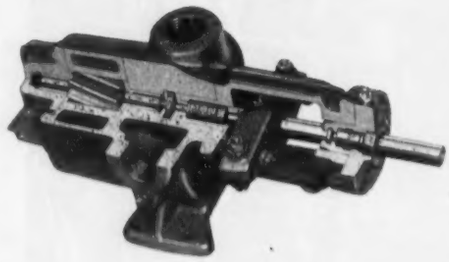

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ARMY (E) NAVY

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problem in many localities where fabricating plants are located, the facilities for producing the metal in all its forms in this country have stimulated a vast interest in the peacetime prospects for this material. The lowered price of aluminum ingot, now 25 per cent below prewar levels, and the fact that many thousands of additional workers are familiar with the characteristics and advantages of aluminum through its widespread use in the manufacture of war materials, give indication of a greatly enlarged civilian market after the war."

Steel Producers Exempted From Pricing Provision

Employers who may be affected by the steel wage adjustments recently ordered by the National War Labor Board are not required to file requests for price increases with the Office of Price Administration to indicate their belief that an increase in wages would require an increase in their ceiling prices. (See STEEL, Dec. 25, p. 42).

Individual employers requesting a price increase based on a wage increase are required to file an application or petition with OPA prior to final action by the NWLB, with the exception of all employers who may be affected by the steel wage case.

Since the decision in the steel wage case may affect many manufacturers, OPA has initiated cost studies of its own to determine what effect, if any, a possible wage increase may have on prices in the steel industry. Therefore, at the request of the industry advisory committee, OPA has determined that it is not necessary for individual manufacturers affected by the WLB wage decision of Nov. 25, 1944, to file formal requests for price relief.

November Iron Output 87.6% of Capacity

Production of pig iron in November totaled 4,840,670 tons, and brought the 11 months' total to 56,317,023. Output of ferromanganese and spiegel was 63,341 tons in November and 623,696 tons for the first 11 months. Total for both was 4,904,011 tons in November, and 56,940,719 tons for the first 11 months.

November operating rate was 87.6 per cent of capacity, and for the first 11 months, 92.2 per cent of capacity.

Foundries, Forge Shops To Be Allowed To Boost Wages

Wage increases will be granted in many foundries and forge shops in order to attract manpower needed to produce critical war supplies, the War Labor Board announced last week. It said pay boosts averaging 10 cents an hour above minimum bracket rates will be authorized in plants certified as requiring such action.

Vinson Reported Ready To Grant Steel Wage Rise

Report OPA says concessions will not require general price increase, but recommends some adjustments on products

FRED M. VINSON, director of economic stabilization, last week was reported to have decided to grant the steel wage concessions recommended Nov. 25 by the War Labor Board and which are estimated by the steelworkers' union to represent an average increase of 8 cents an hour. In addition, the retroactive features of the board's ruling would cost the 86 basic steel companies involved in the case an estimated $160 million, or between $150 and $250 per worker.

The Office of Price Administration reported to Mr. Vinson on the steel companies' ability to absorb the increased labor costs. The OPA report is understood to have held that no general increase in steel prices would be necessitated by the WLB directive, but that consideration would have to be given to price adjustments on some steel products. It was not revealed how far-reaching the piecemeal revisions contemplated by OPA might become.

Asked General Increase

Earlier, the General Steel Products Advisory Committee had asked OPA to grant a general steel price increase to compensate for generally increased operating costs and had warned that further increases would be necessary if the wage increases recommended by WLB were made effective.

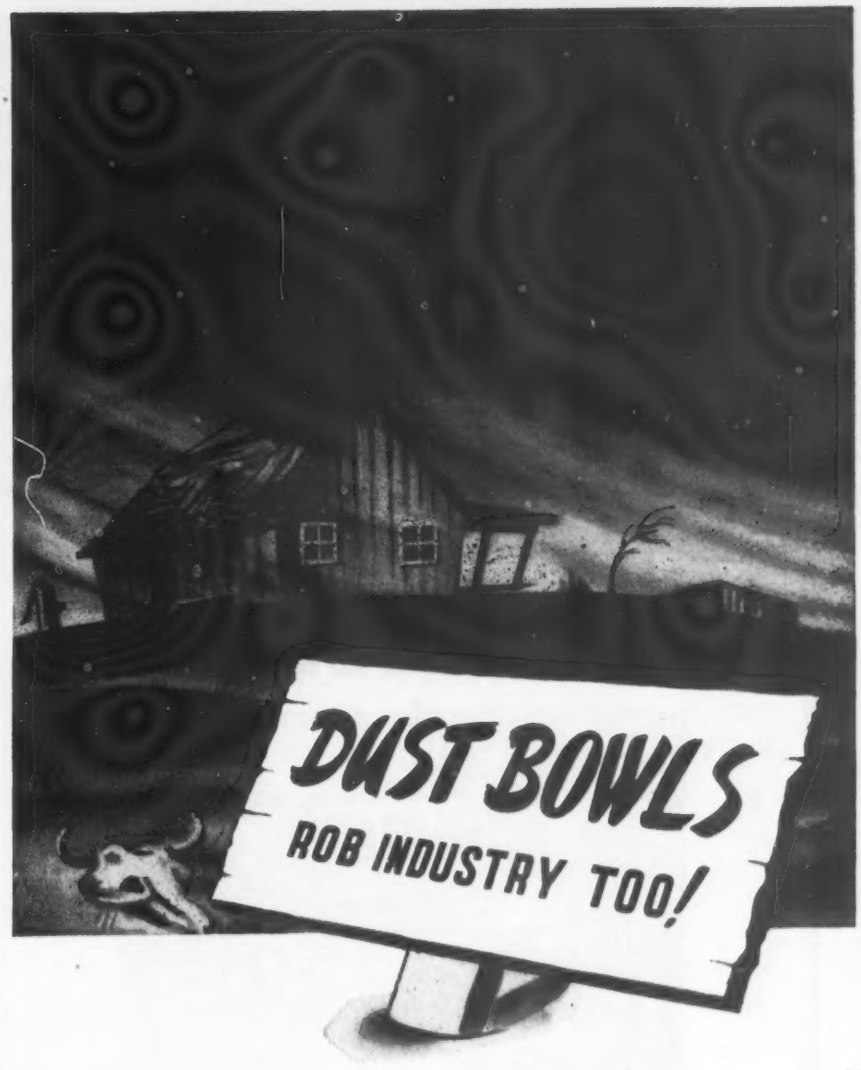
Producers have pointed out that for the past several years they have been absorbing losses of from $3 to $5 a ton on some major steel products, due to frozen prices and generally increased operating costs. The industry as a whole has been able to show a profit only because of the more lucrative prices prevailing on certain munitions items.

November Alloy Steel Production Declines

November production of alloy steels totaled 803,507 tons, about 11 per cent of total steel output for the month, according to the American Iron and Steel Institute. This compares with 842,392 tons in October, and 884,003 tons in November, 1943.

In the first 11 months of 1944, alloy steel production amounted to 9,677,204 tons, compared with 12,316,996 tons in the corresponding period in 1943.

Open hearth furnaces produced 559,231 tons of alloy steel in November, the remainder being made chiefly in electric furnaces.



Dust bowls in industrial plants aren't spectacular but . . . they are devastating! Production Enemy Dust causes equipment breakdowns and increases rejects. Labor Agitator Dust makes workmen discontented and can become a health hazard. Overhead, Cost Expander Dust increases lighting costs, demands more painting, cleaning, and speeds depreciation. Money Waster Dust lets valuable by-products float away unsalvaged. Efficient plants are finding they must rid themselves of these industrial robber dusts.

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Britton Named Surplus War Property Administrator

Mason Britton has succeeded W. L. Clayton as Surplus War Property administrator and will serve in the post until the recently appointed Surplus Property Board takes office. His previous positions with the government included those of assistant administrator, SWP, and director, Machine Tool Division of the agency.

Mr. Britton announced last week that a revised edition of the Buyer's Guide for Surplus Property, which can be obtained from the Superintendent of Documents, is not a listing of surplus property now available for sale through disposal agencies.

Other changes which have been announced recently in war agencies include the resignation of John H. Middlekamp as director of the Automotive Division, War Production Board, effective Jan. 6, 1945. Fred Glover, who has been deputy director of the division since last spring, has been designated to succeed Mr. Middlekamp.

Dr. Julius Hall Parmelee, director, Bureau of Railway Economics, Assocoiation of American Railroads, and Samuel Duncan Black, president, Black & Decker Mfg. Co., Towson, Md., have been appointed alternate management members of the War Manpower Commission's Management-Labor Policy Committee.

Dr. Parmelee, who succeeds Michael J. Gormley, executive assistant of the Association of American Railroads, will serve as alternate for R. Conrad Cooper, assistant vice president, U. S. Steel Corp. Mr. Black succeeds H. Kennedy McCook, consultant of the National Association of Manufacturers, and is alternate member for Frederick C. Crawford, chairman of the board, National Association of Manufacturers, and president, Thompson Products Inc., Cleveland.

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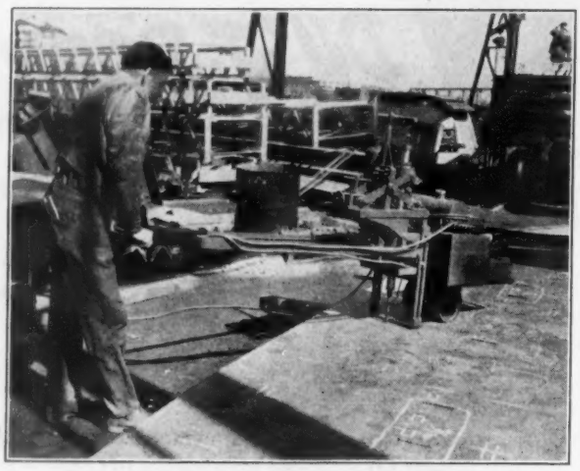

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Restrictions Eased on Signal, Alarm Equipment

Restrictions on the use of copper and copper base alloy in manufacture of 1½-inch and 2½-inch fire hose couplings have been removed by the War Production Board. Other changes which were made in order L-39 follow: Deflectors on sprinkler heads may be made of copper sheet; alloy containing 2 per cent tin is permitted in the manufacture of lever arms of automatic sprinkler heads; restrictions on the manufacture of stirrup pumps and incendiary bomb control equipment have been removed from the order; restrictions on the manufacture, sale and delivery of air raid warning devices requiring motors larger than 3 horsepower, and in the manufacture, purchase, sale and delivery of smoke, fire or intrusion director equipment employing photoelectric principles have been removed.

Inland Steel Merges Metallurgical Activities

Inland Steel Co., Chicago, has established a metallurgical and inspection department by merging the activities of its Indiana Harbor Works metallurgical department, Indiana Harbor Works inspection department, and general office department of inspection and metallurgy. Purpose of the consolidation is to effect unified control over all inspection and metallurgical activities.

The new department will be headed by J. Hunter Nead, chief metallurgist, as manager. E. D. Martin and T. S. Washburn will serve as assistant managers. L. S. Marsh, heretofore manager of the general office department of inspection and metallurgy, will continue in a special metallurgical advisory and consulting capacity.

1945 Aircraft Program Increased 4 Per Cent

Increased military requirements have necessitated upward revision of the 1945 aircraft program. Working schedules drafted in October have been raised roughly 4 per cent for 1945. The new program calls for an annual output of 78,227 planes, an increase from the earlier figure of 75,610.

Steel Production In 1944 Fills All Demands of War

(*Continued from Page* 309)

were able to operate at only 50 per cent of capacity, while demand for castings was heavy, much offered business finding no takers. Late in the year a number of blast furnaces was idle, some not being returned to service after relining.

Pig iron supply and consumption were well balanced during the entire year and the situation was so easy that the practice of allocation by the War Production Board was dropped in January and a free market was resumed, though the board retained the right of supervision to prevent overbuying and accumulation of excessive inventory. The transition was accomplished smoothly and consumers continued to buy on much the same basis as under allocation.

Restrictions on mill purchases by warehouses were loosened toward the end of the year and distributors were urged to increase their stocks to be ready for increased demand when the transition to civilian production should start. During the entire year warehouses were under heavy pressure from consumers unable to obtain wanted delivery from mills and in most cases volume of sales was the best in history, even though assortments were broken and incomplete at nearly all times. Flat-rolled products were most difficult to obtain and these were most in demand.

Wire Needs Were Heavy

Wire needs were heavy during the entire year, most requirements being linked with the war effort, notably wire rope and communications wire. Mill backlogs were overloaded and at no time were makers able to make appreciable progress in reducing the burden. Much of this material required considerable processing and these departments were especially busy. Shifts in the nature of war needs changed the picture from time to time but did not reduce the volume required.

Railroads, performing a stupendous task in transportation of war material, found increased need for additional rolling stock and motive power as wear and tear reduced the number of effective units. Accordingly, the War Production Board afforded such relief as was possible under stress of war requirements and in the closing months permitted additional orders for cars and locomotives as well as considerable tonnage of rails for track rehabilitation in 1945. Requirements for the Army for rolling stock in foreign fields provided heavy orders for cars and locomotives. The provisional government of France also came into the market for a large total of railroad equipment. Thus car and locomotive builders were provided much work.

Late in November the War Produc-

STILL A BIG JOB AHEAD

The Army and Navy are calling for more guns, more ammunition, more trucks, more of the materials to win the war.

Our Generals and Admirals say they are necessary. That satisfies us.

They are asking for more men in these essential industries. They have taken steps which they hope will make this possible.

But, it may be difficult to get the hundreds of thousands of additional trained men in the right place at the right time.

However, a little better planning in each plant, a little greater effort on the part of each individual will bring about a greater utilization of facilities and give us the increased production that's needed.

This is no time for slowing down. It's the time to work harder just as our boys in every branch of the service are doing with the determination to win the war quickly.

Let's all keep the pace they are setting. Let's all help Uncle Sam keep the grindstone turning.

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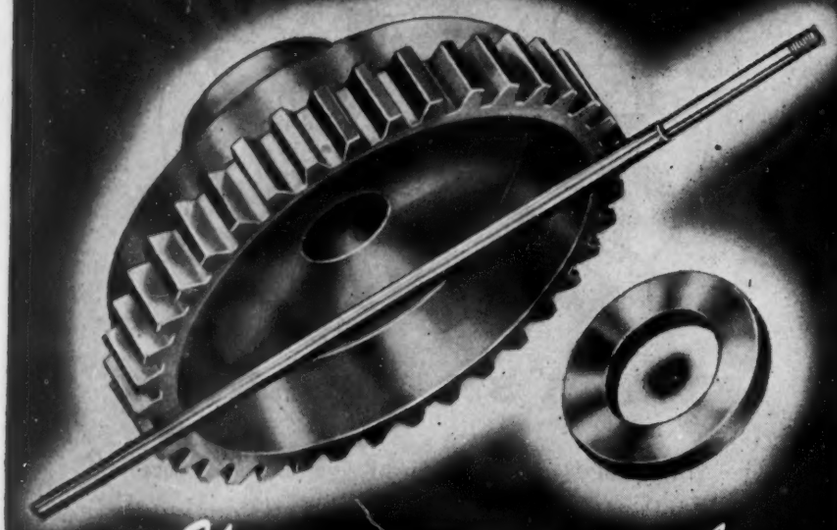

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tion Board notified Office of Defense Transportation that supply of controlled materials for domestic transportation in first quarter of 1945 would be increased over the final quarter last year but would be less than requested by ODT. First quarter allocation of carbon steel under the Controlled Materials Plan was set by the War Production Board at 1,254,838 net tons, against an allotment of 1,039,100 tons in the final quarter of 1943. Request had been made for 1,585,847 tons. Allowance for steel rails for first quarter was 507,000 tons of the 600,000 tons requested. This was stated to be total rail capacity, less military and export requirements. Materials were made available for construction of 2300 boxcars for delivery in second quarter of 1945 and also for a limited number of passenger train cars.

As a result of control measures, there was less difficulty in supply of nonferrous metals last year and in some instances reserves were increased. Tin continued in short supply, though easier than in the preceding year. Conditions were such that in November War Production Board increased the quota for tin plate for first quarter, 1945, by 125,000 tons over fourth quarter, to 900,000 tons. About 150,000 tons of this were earmarked for export. Zinc was in better supply, as domestic production was increased, but galvanized sheets were perhaps the most difficult to obtain last year of all products. However, this shortage depended more on supply of sheets for coating than on supply of zinc.

Body Armor Still Being Used To Save Lives

Contrary to a widely-held impression, personnel armor never has been abandoned completely in warfare, according to the American Iron and Steel Institute. In modern warfare, it is impracticable for members of the armed forces to wear a complete suit of armor. To be effective against rifle fire, troops would have to wear up to 15 pounds of armor per square foot of coverage. Even in medieval times, soldiers grumbled at the weight of body armor, and they were paid a bonus for wearing it.

Today's armor is designed for use at certain periods of time and for special purposes. Thus, leg armor is available for Army engineers who are engaged in clearing ground mines. Airmen are protected against flak by armor for the head and torso and also by an apron for the thighs.

Republic's Sponge Iron Plant Starts Operations

Operation of its new sponge iron plant has begun at the Warren, O., works of Republic Steel Corp. The plant was designed more than two years ago when Republic was having difficulty in obtaining enough alloy-free scrap for its Canton, O., electric furnaces.

Private Business In Europe Is Put To Test by War

(*Continued from Page* 303)

the Emergency Powers (Defense) act 1939. The effect of these regulations on industry and trade are that, although factories and commercial undertakings are still owned and operated by private enterprise the owners of these undertakings are wholly governed by official regulations in regard to recruitment of labor and conditions of work, obtaining raw materials, the products they can manufacture, the prices at which they can sell; in fact they have practically no initiative left. It is such a system that certain sections of the community, in Great Britain and elsewhere, would like to see continued when the war is over; it is one aspect of their concept of the new order.

All who have had anything to do with production or distribution during the war have experienced the effects of such a system of government control and have formed a judgment upon them. There lies the conflict of creed in all its acuity.

Modified Controls Needed

There are, however, other ways in which a government can exercise some form of control over industry and trade without going to extreme measures and it can be quite definitely stated that all reasonably minded people recognize that some mitigated form of control will have to remain during the postwar period of transition which will probably last for some time. Many also think that something should be done, permanently to limit the powers of large combines and of the more powerful undertakings, and to protect the legitimate interests of smaller firms, workers and consumers. It is thought also that the smaller firms and small private owners should be compelled in some way to see to it that their employes are afforded decent conditions of work and that these undertakings should be efficiently operated without price cutting and other obnoxious forms of competition.

Therefore, for a time, it must be expected that direct government control will continue to be exerted on the availability of raw materials and labor, on the nature and quality of goods produced, perhaps on prices of essential products, and that certain priorities will be defined, in order gradually to resume what will be postwar normal conditions —that is, a balanced economic system adapted to the new set of circumstances. In deciding on such controls, the various industries and trades should be brought into consultation with the government, as in fact is being done in Britain today.

With regard to future permanent relations between the government and in-

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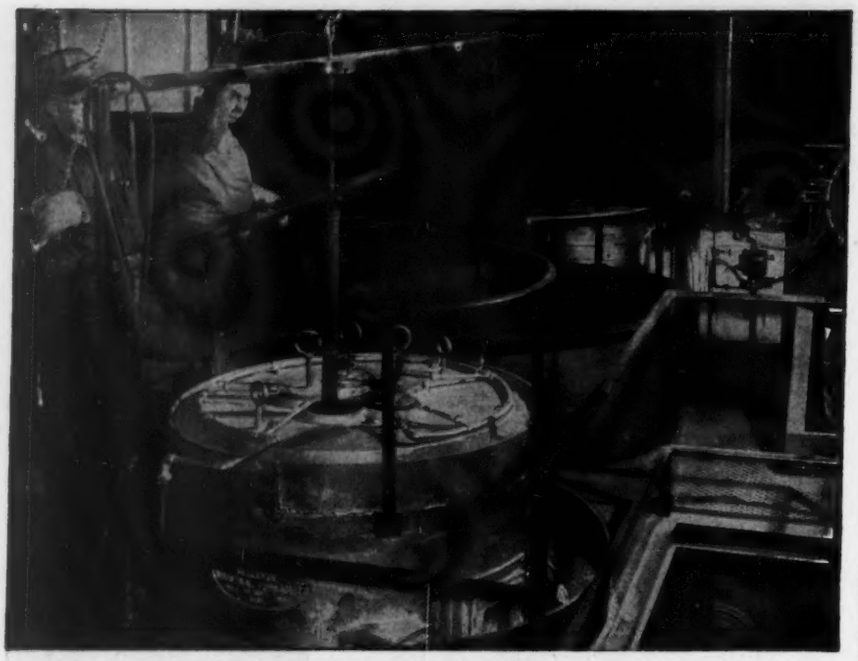

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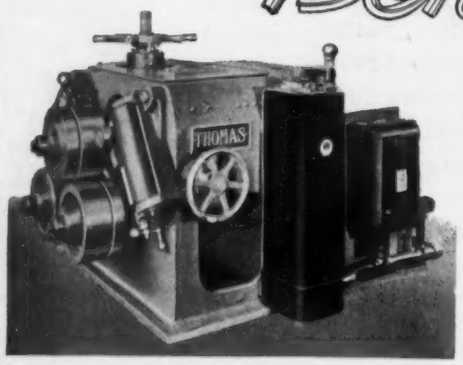

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dustry and trade, there is a very strong movement of opinion against the preservation of the system of regulations and orders issued by government departments as exemplified by the Emergency Powers (Defense) act. There is the strongest opposition against a system whereby thousands of regulations, affecting the conduct of business in its minutest details, can be imposed upon industry and trade, almost without redress and implemented by government officials. Such a system has been accepted as a wartime measure but its operation has given rise to considerable aversion for such a form of coercion. Actually, several ministers have publicly stated that it was their desire to remove as soon as possible controls that were no longer essential.

It would seem that the necessary guarantees of fair dealings without clipping the wings of private enterprise (in the actual sense of these two words) can be achieved by the normal process of legislation. Let Parliament pass laws to prevent exaggerated profits being made by unethical means to prevent artificial restrictions of production of essential goods, to insure decent terms to wage earners both as regards earnings and conditions of work, and generally to curb unruly activities. The penalties incurred by those acting in defiance of the law should be sufficiently heavy to act as a deterrent. Traders would thus be protected against direct government interference and in case of alleged default on their part, would have the safeguard of being tried by the judiciary, in full independence of the executive, and traders, consumers and wage earners alike would then revert to their own parliamentary institutions, and decide of their own fate.

Trade Associations Strengthened

Another development that has been intensified by wartime conditions in Britain is that of trade associations. The formation and strengthening of such associations has been stimulated and encouraged during the war mainly from two directions; on the one hand, the desire on the part of trade sections to defend the legitimate interests of their members against encroachment from government departments, on the other hand the desire on the part of government departments themselves to save considerable time in negotiations with trade interests and to be reasonably assured that such trade interests have a reliable channel through which they can voice their opinions. There is no need to stress the beneficial functions of trade associations from the point of view of research work, improvement of efficiency, negotiations with the government, other trade groups and other official bodies, and in many other directions such as relations with similar associations in other countries.

There has, however, developed a certain movement of opinion against trade associations, not only among consumers but also among certain industrialists and traders.

The antagonism of some consumers

may be partly due to a misapprehension under which they relate trade associations to price fixing rings and other such practices seemingly directed against consumer interests. Such consumers would almost prefer government control over trades, to control by associations. They do not seem to realize that, without necessarily fixing a high ceiling to prices, trade associations should see to it that manufacturers do not sell below costs, thus bringing about ruinous competition, nor should they sell at a low price to the detriment of the quality of the product.

Some traders, on the other hand, resent what they consider to be possible interference of trade associations in the conduct of their own affairs. They fear also that associations may be granted powers to make membership compulsory; there is no valid reason to think that such an enabling act would be passed in favor of trade associations, nor is there any marked tendency on the part of associations to ask for such an act. At all events, the interests of consumers and traders can be protected by legislation that would prevent trade associations from embarking upon harmful activities. The problem could also be met by arranging for representation of consumer interests on trade associations, or by appointing independent tribunals, possibly with government co-operation, to arbitrate in contentious cases.

Calls for Conciliatory Attitude

Given a conciliatory attitude on the part of all interests concerned, built up on a genuine desire to improve conditions as they were before the war, and provided that those responsible for the direction of affairs go to the roots of the problems they have to solve, it should be possible to build up a relationship between governments, trade associations and traders, workers and consumers, that would go a long way to establish prosperous conditions for the years to come.

In Great Britain activities continue to be concentrated on war production and the government maintains its hold on the reins of industry. However, a certain amount of attention is beginning to be given to postwar problems, mainly in regard to the transition period. Two main problems must be grappled with: The problem of manpower, and the revival of export trade. Dealing with the first point, there have been signs of uneasiness among workers because there have been occasions when men have been given notice owing to the sometimes abrupt termination of government contracts. Obviously a period follows during which highly organized works must be re-equipped for a new type of production; in some cases also no new contract of any size has been acquired to take the place of the old one and little facility is as yet made available to undertake civilian work. Such conditions are not likely to be of long duration in any specific case and the resulting "floating" unemployment should not be a serious problem; the

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*William Turner, of the U. S. Navy, was killed in action in the Coral Sea Battle.

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government is giving its attention to the matter.

Actually labor has been somewhat more restless during 1944 than in previous war years, as indicated by the fact that 3,291,000 working days have been lost through strikes down to Sept. 30, as against 1,153,000 in the first nine months of 1943. The coal mining industry is mainly responsible for the number of disputes, and lost 2,323,000 working days in the first nine months of 1944. Most strikes were unofficial and not supported by the unions. Wages generally have followed an upward trend, but it would seem that higher wages do not necessarily bring about increased production.

Postwar labor problems will require much care and attention if conflicts are to be avoided, and the government will have to give sympathetic leadership and advice to employers and workers alike. On the other hand, there appears to be no likelihood of serious unemployment for some years to come.

Everyone in Britain is conscious of the necessity for the early resumption of export trade, to a substantially higher degree than in prewar years owing to the loss of British assets abroad and the increase of Britain's external debt. Despite official encouragements, manufacturers are still constrained in planning ahead by the numerous existing controls and the indefiniteness of government plans.

On the continent of Europe, it will be seen that a substantial drop in iron and steel production has taken place owing to heavy bombing of the Ruhr plants and to the advance of the Allies. Germany can now only use what is left of her own capacity, and the plants in operation in Austria, Moravia and Poland.

It does not seem that any considerable destruction of iron and steel works has taken place in France, Belgium and Luxemburg. The coal mines also have not apparently suffered considerable damage. Production in these countries must now be at a low ebb owing, mostly, to difficulties of manpower and transport but an upward trend can be expected in 1945.

Any attempt to compute postwar capacity of production in Europe is premature at this stage. It will take time to bring back to full operation the badly damaged German plants of Essen, Dortmund and other Rhenish-Westphalian centers, and little is known of Russia's position. One may visualize, however, that within three years of the cessation of hostilities Europe's output of steel may again equal, if not exceed, the level of production of the years 1937 to 1939.

Alaskan Coal Can Be Used In Making Synthetic Fuels

Coal from four districts in Alaska can be used to produce synthetie gasoline and other liquid fuels, the Bureau of Mines, Washington, announces following conclusion of a series of tests.

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Steel Industry In Britain Looks To Postwar Era

(*Continued from Page* 305)

would give consideration to the proposals for redundancy when he was satisfied that the new plants were going to be on sites in accord with the public interests. There had been talk about the location of industry, and he would not be a party to the dislocation of the Welsh tin plate industry. Plans for improved communications for Wales were being worked out in considerable detail by the ministry of War Transport and representatives of the Board of Trade.

Steelmakers on the whole take a hopeful view of the postwar position of the industry, though there is no denying the irritation felt at the present stage by the lack of a government policy in regard to export trade and the reluctance on the part of the government to release materials, not only for export but also to meet the needs of an ever growing commercial domestic market. Sheffield steel and tool producers are complaining that while the need for establishing oversea contacts is an urgent one they are prevented from sending representatives abroad to prepare the ground for the resumption of postwar trade relationships.

It does seem clear, however, that a very gradual move in the relaxation of controls has already begun. Galvanized sheetmakers can now go ahead with production as restrictions on the use of zinc have been removed. More steel has also been allocated for the production of textile machinery, and a little more pig iron is being made available for builders' castings. There is a consensus that a sudden sweeping away of all control, much as it is disliked, would be disastrous, not only for the steel trade but for industry as a whole.

Controls Removal To Be Gradual

Official confirmation was forthcoming in a recent speech by Capt. Charles Waterhouse, parliamentary secretary to the Board of Trade.

"I can promise," he said, "that when labor, factories and raw materials no longer required for war purposes are available in any district, the Board of Trade will, in consultation with the industries concerned, immediately take the necessary steps to allow normal production to recommence, preference naturally being given—where a choice exists—to goods essential to civilians at home or suitable for export. It is the intention of the board to ease controls and remove restrictions as opportunity arises, but the removal of such controls must be a gradual process. The control of prices must remain at home; judicious control will undoubtedly be an additional spur to the development of markets overseas. The world is hungry for goods, and British industry has rarely, if ever before,

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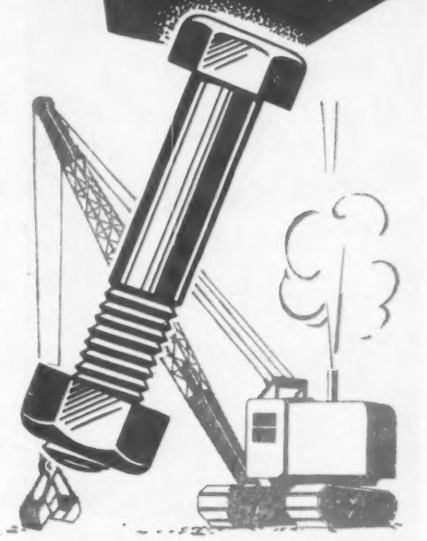

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had such opportunities to relay the foundation of expanding export-trade. But Britain is no longer rich in overseas investments and now has to pay for goods with goods. Uncontrolled prices might be an irresistible temptation to sell too much at home and send too little overseas."

As to the immediate prospects of steel producers, it is anticipated that steel to be used in postwar houses, some of them of the temporary type, may account for a fair tonnage should war needs suddenly cease. A tremendous volume of business from the automobile industry is assured particularly in regard to sheets and the lighter steels, and the machine tool trade must also play an important part. The postwar outlook in shipbuilding and engineering is such that a long period of work is assured. In the Clyde yards in Scotland, the industry is fully equipped to maintain its former supremacy in world competition. Equipment has been improved during the war years and advances have been made in methods of construction.

EXPORTS OF BRITISH IRON—STEEL

Gross Tons

	1938	1942	1943
Pig iron	93,941	1,395	3,347
Ferroalloys	6,762	3,992	1,741
Ingots, blooms, billets and slabs	9,743	342	1,732
Bars and rods	129,085	22,049	11,678
Angles, shapes and sections	67,405	7,243	5,248
Castings and forgings	1,618	322	701
Girders, beams, joists and pillars	33,471	838	517
Hoop and strip	37,377	5,900	2,440
Plates and sheets ⅛ inch and over	130,959	33,989	10,712
Plates and sheets under ⅛ inch	78,051	9,357	3,438
Galvanized sheets	146,933	5,863	1,431
Tinned plates	319,308	45,434	14,841
Tubes, pipes and fittings, cast	91,891	6,772	4,015
Tubes, pipes and fittings, wrought	219,973	17,111	11,211
Steel rails	106,000	10,623	5,661
Sleepers, fishplates, etc.	52,153	5,539	4,862
Wire	55,181	10,884	3,342
Total, including manufactured steel	1,915,202	257,622	133,944

Any anxiety which existed twelve months ago in regard to supplies of iron and steel scrap has disappeared. With falling output of steel, the call for scrap has declined in all areas, and the salvage drives which were a prominent feature in the earlier years of the war have faded out of the picture.

The manpower problem causes some concern to industrialists. They are somewhat alarmed to find that now that production for war purposes has been reduced, they are not being allowed to keep their men for the day when they can revert to peacetime production, but are losing them by call-up to the armed forces. This aspect is closely tied up with the demobilization question upon which the government has issued a White Paper recently but which clearly shows that the overriding principle governing

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Streamlined
BANDING METHOD

In all types of industry—production, maintenance or service—Punch-Lok Banding Method is at work . . . connecting hose, stopping leaks in steam or water lines, splicing electric cable, reinforcing and mending splits in cross-arms, poles and ladder rails, tieing rigid conduit or flexible cable to pipe lines or girders, seizing ends of wire or manila rope to prevent fraying . . . in short, wherever a banding method can be used to connect, mend, splice or reinforce. Open end bands available for use when ends of work are obstructed. There are places in *your* industry where Punch-Lok Clamps would save *you* time and money.

CLAMPS . . . Made of flat, high tensile galvanized steel or of Everdur, which is a corrosion resistant copper base alloy. All clamps are double wrapped. Available from ¾" to 48" I.D. Any larger size clamp can be pulled down to fit any smaller diameter.

LOKING TOOL . . . Sturdily constructed to assure long life. Locks all size clamps with a sufficient tensional pull.

GROOVED FITTINGS . . . For hose lines—air, water, steam or any other fluids. Permits application of high pressure clamping without damage to hose.

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all demobilization will be military needs.

Fortunately for industry, there has been little serious loss of work in the iron and steel trades through stoppages and strikes during the past twelve months. In the coal fields there have been sporadic strikes during the year, these were of relatively short duration; on some occasions more serious disputes have been averted, but in the first quarter of the year alone, over 500,000 tons of coal were lost as a result of stoppage of work. The cost of fuel has increased and the output of coal in the pits is still on the decline. In fact it is agreed that the fuel position this winter is likely to be as acute if not more so than at any period during the war. Blast furnace coke, now selling at 54s ($10.80) per ton has gone up 9s 6d ($1.90) since February, and although the arrangements operated by the government prevent this increase being passed on to the steel consumer at present, it is realized that when that does happen it will result in a sharp rise in the price of manufactured goods. The policy right through the war, and one which has been worked with a great measure of success, has been to stabilize prices and there seems no likelihood of any drastic alterations in the near future, although consumers are anxious to know what they are likely to pay when the war is over.

Assuming that the war in Europe finishes during 1945, there is a good prospect of full employment in the British iron and steel trade provided that it is allowed full scope to resume its old position in the markets of the world on a competitive basis.

Morgenthau Reports on Wartime Uses of Silver

Treasury silver to the amount of 1,226,300,000 fine ounces has been put to work in a variety of war jobs since Pearl Harbor, Secretary of the Treasury Morgenthau said recently. He summed up wartime silver transactions as follows: Provided for nonconsumptive uses in war plants under lease arrangements, 903 million fine ounces; supplied to various foreign governments under lend-lease for coinage purposes and other war uses, 243.7 million fine ounces; sold from "silver ordinary" stock to industrial users certified by War Production Board, 5 million fine ounces; sold in accordance with WPB priorities under terms of the act of July 12, 1943, known as the Green bill, 41 million fine ounces; used as basis of new alloy developed by the Bureau of the Mint for coinage of wartime "silver nickels," 33.6 million fine ounces.

Self Replaces Hambro as British Member of CRMB

Sir Charles Hambro has retired as British member of the Combined Raw Materials Board. His place will be taken by Sir Henry Self, who will also continue as United Kingdom deputy on the Combined Production and Resources Board.

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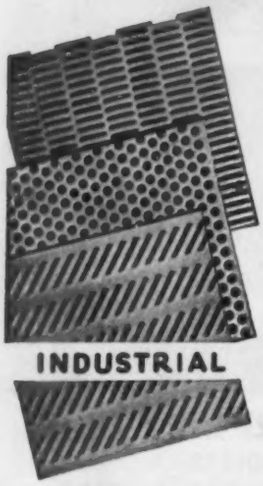

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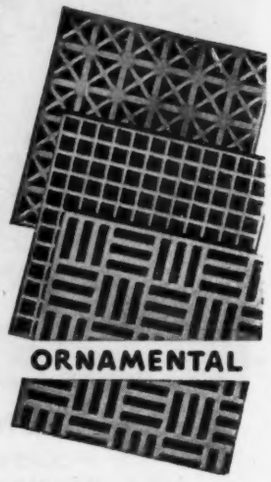

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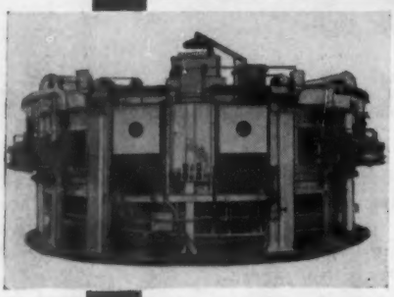

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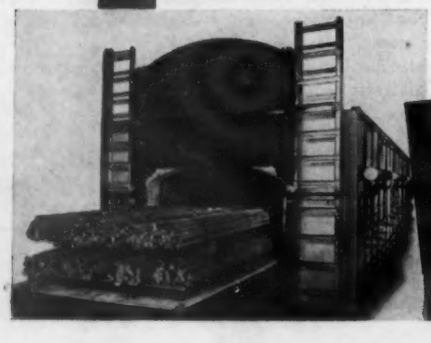

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Nazi Production Hit Severely By Allied Gains

(*Continued from Page 307*)

and because the supply of coal and coke can come either from the Ruhr or from Upper Silesia. The new Hermann Goering plant at Linz never advanced beyond the coke ovens and blast furnaces. Its pig iron output, which is not believed to be more than about a third of its planned capacity of 1,000,000 tons per annum, is distributed to other iron and steel works throughout German Europe.

Iron and steel output has been maintained at about the same level as in 1937 while coal production has greatly increased since the war. Loss of Swedish ore as well as certain supplies from Krivoi Rog and Slovakia will severely restrict operations. The most easterly works are already dangerously near the fighting line.

CZECHOSLOVAKIA

The works in Bohemia having their own ore supply and relying on Moravian and Silesian coke have been able to maintain a good level of operations and may continue to do so, but those in Moravia, although busy early in the year, are henceforth likely to suffer from the loss of Swedish and Slovakian ore supplies. Coal output has been appreciably higher than prewar.

ITALY

The biggest ore deposit and the chief blast furnaces at Piombino, Portaferraio and Bagnoli are already in Allied hands while the remaining blast furnaces are cut off from their ore supply. Moreover, the Germans are removing electric furnaces and rolling mills from the plants still in their possession. The year has been one of complete confusion for the Italian industry.

FRANCE

That part of France which was incorporated into the German Reich—the Department of Moselle—was very busy early in 1944 but the rest of France was used by the Germans mainly for its iron ore. Some was smelted locally but much of it went to Belgium, to the Saar and the Ruhr. Lack of coke due to transport difficulties has never permitted a high level of operations even when the Germans wanted it. The coke shortage is likely to continue for some time. As already mentioned, iron and steel operations fell sharply before D-Day.

BELGIUM

Operations were maintained at about 40 per cent of capacity until April, after which they collapsed owing to transport difficulties.

LUXEMBURG

As in the Department of Moselle, the

Luxemburg plants were well employed early in the year but, due to their reliance on Belgian and German coke, they had to restrict operations severely when transport broke down. Luxemburg iron ore was used considerably in Belgium as well as in the local plants.

SWEDEN

No official figures have been published in regard to iron and steel production in Sweden. It seems likely however, that iron ore production is still at about the normal level of one million tons per annum. The Swedes have expressed the fear of future unemployment in the mines resulting from the cut in exports to Germany, but if unemployment does come it would be shortlived, since Swedish ore will be much in demand as soon as shipments from Sweden to the Allies become feasible again.

RUSSIA

Insufficient information is available to justify a summary of the Russian iron and steel situation. It can be presumed, however, that steelworks that were operating behind the maximum German advance line are in full activity, and that works in recaptured regions are being rehabilitated with the greatest possible speed. Since the iron ore and coal mines have also been recovered it is more than likely that the output of iron and steel in Soviet Russia in 1944 will reach a higher level than at any time since the beginning of the invasion.

Industrial Diamond Supply Assured for 1945 Needs

An adequate supply of industrial diamonds is assured for essential American uses during the first half of 1945 through an accord reached with the British Ministry of Supply. While supply and demand are in some degree of balance, users have been advised to confine their purchases where possible to the broad requirements for the jobs to be done rather than to critical specifications of type, size, and shape when not essential.

Importers Show Interest In Chicago Connections

Importers of American products in countries not dominated by Axis powers are showing increasing interest in making trade connections with Chicago exporters for the postwar era, according to Harry Salinger, foreign trade vice president of the Chicago Association of Commerce.

Bimetal Monetary System Advocated by Brownell

United States has the opportunity to win both commercial stability and international leadership by establishing the soundest monetary system the world has known, declares F. H. Brownell, chairman, American Smelting & Refining Co.

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First to design milling cutters especially to fit the characteristics of Tungsten Carbide.
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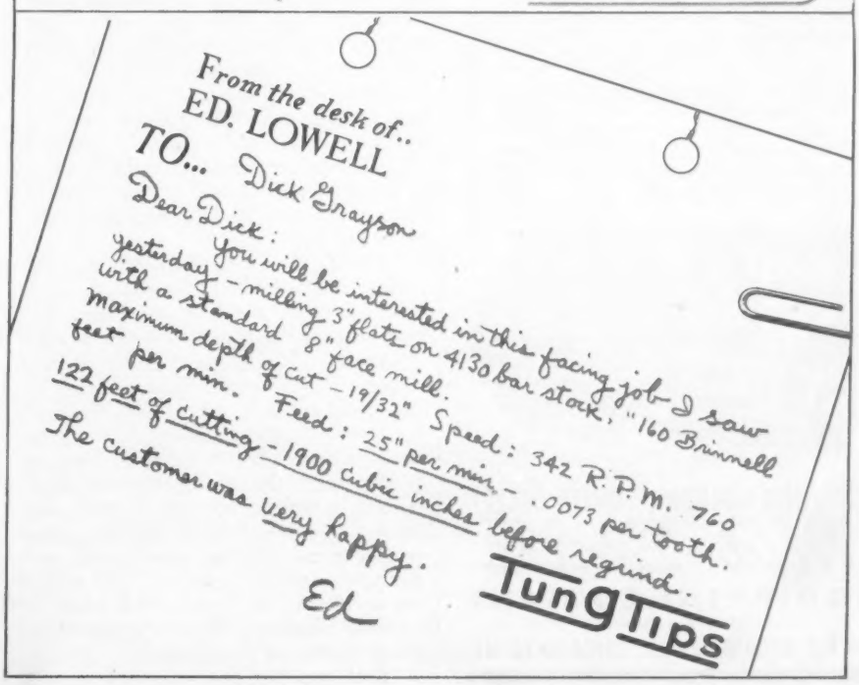
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Dear Dick:
You will be interested in this facing job I saw yesterday - milling 3" flats on 4130 bar stock; "160 Brinnell with a standard 8" face mill.
Maximum depth of cut - 19/32" Speed: 342 R.P.M. 760 feet per min. Feed: 25" per min. - .0073 per tooth.
122 feet of cutting - 1900 cubic inches before regrind.
The customer was very happy.
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The Saw-Gun, illustrated above, will definitely speed up sawing and filing operations in your plant. Attach it to an electric drill, or propel it with compressed air or flexible shaft. Insert a hack saw blade in the holder and cut into metals of every description with astounding speed. Works equally well on plastics, wood and other materials. Ideal for panel notching and slotting operations. It's portable . . . carry it from job to job. For filing operations insert a file in special holder.

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Active Postwar Demand for Mill Equipment Seen

MANUFACTURERS in the steel, brass and aluminum industries are now engaged in making a thorough and comprehensive review of their operations to determine what modifications and changes should be made in the postwar period, reports G. E. Stoltz, manager, Metalworking Section, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., in a yearend statement.

A number of new processes have been adopted by metalproducing industries, he states, but rather than there being any indication that operations are stabilized, it seems evident that there will be greater activity in new designs and installations of mills, furnaces and other processes.

"The air around a blast furnace carries a great deal of metallic and carbon dust," Mr. Stoltz said, and "it has been found by some that there is sufficient dirt in the atmosphere to cut the propeller blades of the turbo blower used to force the air into the blast furnace. The cost of replacement of the propellers is found to be great enough on some furnaces to justify cleaning of the air by means of a precipitron electrostatic air cleaner.

Twin Motors Used on Plate Mill

"An important method of driving main rolls is the use of twin motors on a large reversing 4-high plate mill. This method of drive has been used in the past on large slabbing mills, but not on this type of finishing mill.

"There was a question as to whether the two motors would synchronize close enough to avoid delivering plate as thin as 3/16" without causing it to curl up in the air, or feed down between rollers on the main tables. Sufficient operation has been obtained to know that this problem has been successfully solved. Smooth operation is obtained with little backlash in the drive and there is no possibility of obtaining pinion marks on the plate from the worn gears.

"Another new application of apparatus for main roll drives is the use of a rectifier to supply power to the direct-current motors used on a merchant mill. There are 14 different direct current motors used to drive various stands of this merchant mill, all of them designed for 600 volt service. Instead of supplying the customary motor generator set to transform the A-C power to direct current, a 6-phase ignitron is used. The ignitron is more efficient than the motor-generator set and has considerable momentary overload capacity. The motors are accelerated to their normal speed by variable voltage. This is obtained by phase control of the ignitron.

"Rolling of flat products, such as strip,

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METAL
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THE LEGIBLE WATER PROOF STICK O'PAINT

ALL THE QUALITIES OF PAINT WITHOUT THE MESS AND WASTE.

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WRITE FOR THE PAINTMARX FOLDER AND INDUSTRIAL CRAYON GUIDE.

THE AMERICAN CRAYON COMPANY

tin plate and sheet in the steel industry and brass strip and aluminum foil in the nonferrous industry continue to develop along the line of producing still thinner gages.

"In the steel industry, strip 13 inches wide by 0.0015-inch thick is being regularly produced on a reversing cold cluster mill. The control for such a mill must be carefully designed even for mill operation down to practically standstill speed in order to avoid breakage of a thin strip.

"Brass as thin as 0.004-inch thick will be rolled on a 4-high reversing cold mill with similar type of tension control. In the aluminum industry, the rolling of foil is being extended down to gages as low as 0.0002-inch. The success or failure of such a mill, as far as electrical apparatus is concerned, is the accuracy of synchronizing the main roll drive with the reel drives through the entire speed range and the obtaining of accurate tension control.

"The plating industry was given considerable impetus with the installation of the electrolytic tin plating lines. Some of these lines are now being used to plate zinc and new zinc lines are under consideration for postwar installation. Considerably more plating apparatus, either of the commutator or Rectox type, is needed to plate zinc than tin, unless the operators are willing to run their zinc plating lines at considerably lower speeds than for tin plate.

Large Installations Made

"During the last five years, a million kilovolt-ampere capacity of electric arc furnaces has been installed. This has been done to supply alloy steel for munitions. Most of the installations which have been made are of large capacity furnaces using up to 15,000 kilovolt-amperes of transformers.

"This increased capacity and the fact that means have been developed for increasing the life of the furnace lining should broaden the application of electric arc furnaces.

"Full capacity of the electrical equipment is used during the melting down period and a reduced capacity during the refining period. Considerable study has recently been given to providing maximum power for the furnace for any given voltage tap, particularly during the melting down period.

"Electrical input is controlled by the operator by adjusting the amount of current each electrode takes. If the operator should adjust this particular control to obtain current above 50,000 amperes, the furnace would absorb less heat than could be obtained at the maximum point. Some operators feel that they are increasing the input when they raise the electric current to its maximum value. To avoid this error, furnace controls are now being installed to limit the input to the maximum kilowatt possible for each furnace tap. This should contribute towards economy of operation in making electric steel.

"A new type of control has been de-

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TO A PRODUCT EXCEPT COST
flexibility
CLARK
Another PRODUCT of CLARK EQUIPMENT COMPANY
Load carrying vehicles must be flexible to handle many types of materials.
CLARK fork trucks
have adjustable "arms of steel" to lift, carry or stack loads up to 7,000 lbs.
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veloped using rotating regulators that match the current input per electrode against its voltage across the arc. Three independent motor-generator sets are used, one for each electrode. Each of these sets consists of a generator which supplies power to an electrode motor, rotating regulator and an A-C driving motor which operates on a 440-volt, 60-cycle or similar available supply.

"All electrical connections to each of these rotating regulators are made through a receptacle on top of the sets. A spare regulating set can be inserted in the circuit merely by removing the jack connector block and inserting it in the spare set. This permits inspection or repair of any one of the three sets without interfering with furnace operation.

"Induction heating is being used in heat treating, melting and forging operations. A number of sets has been installed to heat the ends of shells for the nosing operation. The amount of heat generated in the end of the shell can be graduated so as to obtain a smooth rate of curvature from the body of the shell to the end of the nose. The demand for this type of power has grown to the point where high frequency power is distributed from a centralized bus and as many as four 600 kilowatt, 3000-cycle generators are operated in parallel. They are connected to the bus at no voltage and field currents built up simultaneously.

"Investigations are being made in regard to the use of frequencies in the neighborhood of 200,000 to 450,000 kilocycles using oscillator tube generators similar to the equipment installed on tin flowing lines."

New Standard for Steel Lockers Now in Print

Printed copies of simplified practice recommendation R35-44, Steel Lockers (Single, Double, and Multiple Tier), are now available, according to the division of simplified practice, National Bureau of Standards. This recommendation will be effective when materials which are now critical become available. As compared with the superseded issue, R35-28, the revised recommendation eliminates two sizes of single-tier lockers, and adds two sizes of double-tier lockers and three sizes of multiple-tier lockers. It also changes the size of one multiple-tier locker; and certain changes and additions have been made in the footnotes to the tables and the text.

More Than $3 Million Go Into Chicago Area Plants

New plant construction and extension of manufacturing facilities for war or peace in the Chicago area in November represented an aggregate investment of $3,897,791. According to the Industrial Department, Chicago Association of Commerce, this activity brings to a total of $68,825,707 the new investments in the area's industrial plants for the first 11 months of 1944.

For Schenectady

45,000,000 Gallons Daily From 9 Layne Units

Late in 1942, Schenectady faced a water crisis. New war industries and increased population demanded more and more water. The old system was over-burdened. Reserve was diminishing a million gallons daily.

Layne was given a contract that covered wells, pumps, electrical equipment and other essential apparatus. Layne New York Company put full crews on the job and in record time completed two wells in time to prevent a crisis. Seven other wells and pumps were soon ready and in service, giving Schenectady 45,000,000 gallons of fine water daily—and at a saving of $10,000 a year on operating cost.

Though constructed at extraordinary speed, operation was perfect and efficiency up to the guarantee. No other firm in America,—or perhaps in the entire world could have matched Layne's overall performance.

Layne Wells and Pumps are the world's finest in quality, efficiency, design and long life. For late literature address, Layne & Bowler, Inc. General Offices, Memphis 8, Tenn.

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LAYNE

WELL WATER SYSTEMS

VERTICAL TURBINE PUMPS

Committees for Gray Iron Founders' Society Named

Appointments to four standing committees of the Gray Iron Founders' Society, announced by Walter L. Seelbach of Cleveland, president, include:

Cost Committee — H. L. Edinger, Barnett Foundry & Machine Co., Irvington, N. J., chairman; J. H. Bruce, Bowler Foundry Co., Cleveland; C. R. Culling, Carondelet Foundry Co., St. Louis; C. B. Magrath, Greenlee Foundry Co., Chicago; Donald McDaniel, Hamilton Foundry & Machine Co., Hamilton, O; S. C. Mefford, Auburn Foundry Inc., Auburn, Ind., and Henry S. Washburn, Plainville Casting Co., Plainville, Conn.

Educational Committee—Edward C. Hoenicke, Eaton Mfg. Co., Detroit, chairman; A. C. Denison, Fulton Foundry & Machine Co., Cleveland; H. S. Faust, Hansell-Elcock Co., Chicago; Frank J. Sherwin, Chicago Hardware Foundry Co., North Chicago, Ill., and L. J. Wischerath, Buffalo Foundry & Machine Co., Buffalo.

Technical Committee — Edward L. Roth, Motor Castings Co., Milwaukee, chairman; Frank J. Dost, Sterling Foundry Co., Wellington, O.; T. E. Eagan, Cooper-Bessemer Corp., Grove City, Pa.; R. A. Flinn, American Brake Shoe Co., Mahwah, N. J.; W. W. Levi, Lynchburg Foundry Co., Radford, Va.; R. D. Phelps, Jr., Francis & Nygren Foundry Co., Chicago; Donald J. Reese, International Nickel Co. Inc., New York, and, ex-officio, A. J. Edgar, Washington, the society's technical adviser, and W. O. McMahon, Birmingham, Ala., southern area technical consultant.

Terms of Sale and Trade Practice Committee—Peter E. Rentschler, Hamilton Foundry & Machine Co., Hamilton, O., chairman; William J. Grede, Grede Foundries Inc., Milwaukee, and D. J. Vail, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.

New Cast Iron Pipe Firm Organized in the South

Joseph M. Franklin, for 18 years vice president of the Central Foundry Co., Holt, Ala., has purchased the buildings and land of the Walworth Co. plant at Attalla, Ala., and starts on Jan. 1 to produce cast iron pipe and fittings under the corporate name of Attalla Pipe & Foundry Co.

Mr. Franklin has resigned as vice president and manager of Southern properties for Central Foundry and will be president of the Attalla Co.

Electroplaters' Society To Meet in Pittsburgh

American Electroplaters' Society will hold its 1945 annual conference in Pittsburgh June 18-21. S. S. Johnston, Weirton Steel Co., Weirton, W. Va., who is president of the Society's Pittsburgh branch, is general chairman of the conference committee.

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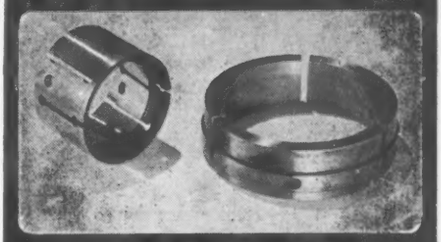

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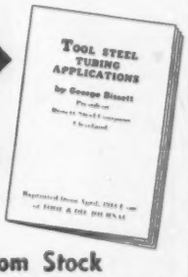

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Steel Earnings Decline in 1944 Despite Record Production

SUCCESSIVELY in each of the five years since the war began, American steel plants have broken all prior records for total steel production, stated Walter S. Tower, president, American Iron and Steel Institute in a yearend statement.

For 1944, the tonnage of steel ingots and castings produced reached a new peak estimated at 89,400,000 tons—80 per cent above our maximum year's output in the first World War and almost 1½ times the probable 1944 production in enemy Europe.

Because of declining orders in the last half of 1944, the increase over the 1943 production is not great, amounting to about 600,000 tons. The peak in production was reached during March. After that month, both orders for and production of steel declined gradually. Production in the final six months of the year was almost 70,000 tons below output in the corresponding months of 1943.

New payroll records were also established during 1944. A total of $1,700,000,000 in payrolls was paid to employes during the year, of which more than $1,400,000,000 went to wage-earning employes.

Hourly earnings likewise reached a new high figure, with wage earners during the year averaging $1.19 per hour, or 5 per cent above 1943. Weekly earnings averaged $56 during 1944, as against $49, in 1943. Those figures do not take into account any retroactive increases in pay resulting from the War Labor Board decision announced late in 1944.

Net profits of steel companies in 1944 were considerably lower than in 1943, despite higher production levels. Total earnings (after taxes) for the year will probably approximate $170,000,000, compared with $201,000,000 in 1943. In 1937, a good recent peacetime year, the steel industry netted a total of $232,000,000.

Low as the 1944 company earnings were, representing a return of less than 4.5 per cent on investment, they are certain to go lower, possibly even to the vanishing point, in 1945 unless prices are increased to compensate for the higher wages established by the labor board ruling. Prices in the industry have been frozen at 1939 levels since April 1941, notwithstanding steadily advancing costs.

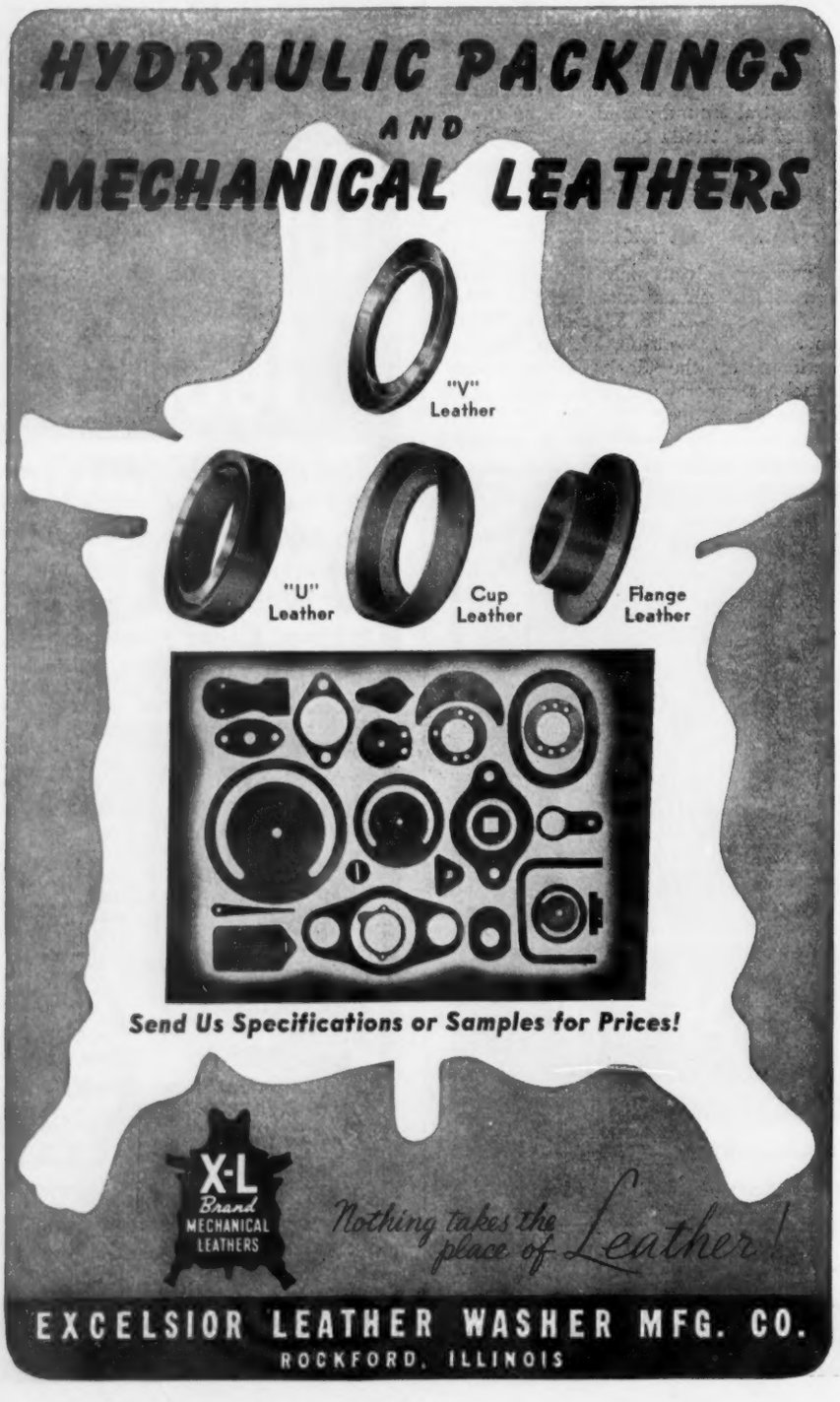
U. S. Steel Chairman Calls For Continued Production

V-E Day has not arrived, and the primary job of all of us must continue to be an all-out effort to attain complete victory over both Germany and Japan, said Irving S. Olds, chairman, United States Steel Corp. in a yearend statement.

"American industry can be proud of its remarkable production record since Pearl Harbor," he said. "But this is not the time to lessen the nation's productive effort, or to rest content with past achievements. The character of the war is constantly changing, and with these changes come demands from our armed forces for huge quantities of new and improved munitions and materiel, made of steel. The steel industry, which so far has met every war call made upon it, is resolved to do its utmost toward supplying steel in full quantity when and as needed in the war program.

"We of United States Steel are honored to have had one of our mills selected as the pilot plant for the production of eight-inch shells. Other corporation plants are also delivering big shells in large quantities. Men and management at all of these mills will not be content until their shell production schedules are met completely—and on time.

"When the war has been won, the patriotism, courage, energy and resourcefulness of the American people—outstandingly demonstrated during the war—will be a most vital factor in the solution of any difficulties of the postwar period."



Strong Demand Continued for Nickel in 1944

Essential war materiel takes virtually entire output. Labor shortage prevents new record of production

"DEMAND for nickel continued strong during 1944 with virtually the entire production consumed in essential war materiel," Robert C. Stanley, chairman and president, the International Nickel Co. of Canada Ltd., Copper Cliff, Ont., declared in a yearend statement.

"While nickel supplied to the United Nations in 1944 has been high, the total for the full year will not equal that of 1943," Mr. Stanley continued. "It will, nevertheless, be substantially larger than any peacetime year. Had it not been for the shortage of labor at the mines, absenteeism and the lowered efficiency resulting from the necessity of absorbing and training inexperienced labor, Canadian nickel production would have achieved a new record.

"Because of these conditions, full advantage could not be taken of the increased plant capacity which has been provided in the past few years. Output was sufficient, however, to fill the war demands of the United Nations.

"The greater part of the world's supply of nickel in all forms comes from Canada, which country during 1944 was able to deliver to the United Nations over 50 per cent more nickel than during the prewar years.

War Demands Absorb Supply

"It will be recalled that the importance of nickel made it one of the first metals to be put on a priority control basis. The nickel requirements of the armed services, war production and essential services have continued at a high rate and have absorbed virtually the entire nickel supply. Therefore, the release of any appreciable quantities of the metal for civilian purposes must await cutbacks from the present rate of war orders.

"It is estimated that present production facilities will insure an adequate supply of all nickel requirements expected after war demands are over. Nickel will come out of the present conflict with a much more favorable outlook than at the close of the first World War.

"The steel industry continued to be the largest consumer of nickel in 1944, requiring approximately two-thirds of the metal for the production of stainless and engineering alloy steels. The next largest consuming industries were those producing copper-base alloys and the nickel-chromium alloys for electrical and heat resistance.

"Figures recently made public by the American Iron and Steel Institute show that the total production of stainless steels in the United States during 1943 set a new high record despite war restricted use of chromium and nickel employed in the well known 18 and 8 type of stainless steels. While figures for 1944 are not available, a relatively high rate of stainless steel production has undoubtedly been maintained this year. The use of these steels is currently confined to the most essential of military requirements. The postwar era will no doubt see an even greater utilization of stainless steels, since their excellent mechanical properties as well as their corrosion resistance fit them into many industrial applications other than the decorative purposes which made them popular during prewar years.

"Development of the National Emergency (NE) steels in the United States is one of the outstanding metallurgical accomplishments of the war. They were developed in 1941 by metallurgists of industry and government and have accomplished the purpose of stretching supplies of alloying elements.

"The wide acceptance of the NE steels has made nickel of much broader usefulness to the United Nations' war efforts. Through them it was possible to apply the metal to a substantially larger steel tonnage to meet the requirements of the Allies. Enlarged utilization of the

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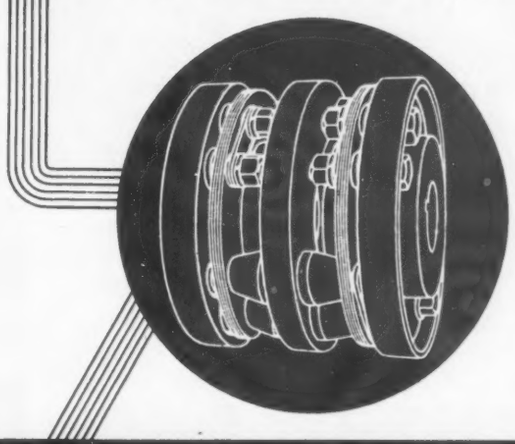

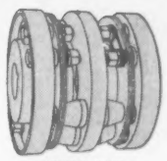
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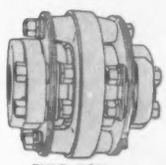
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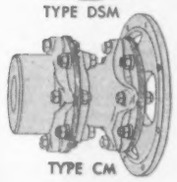
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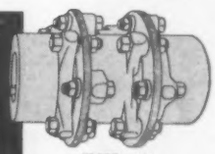
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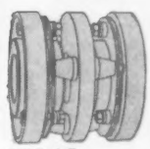
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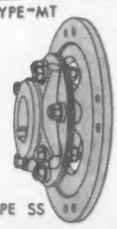
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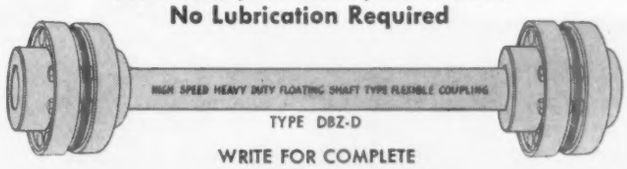

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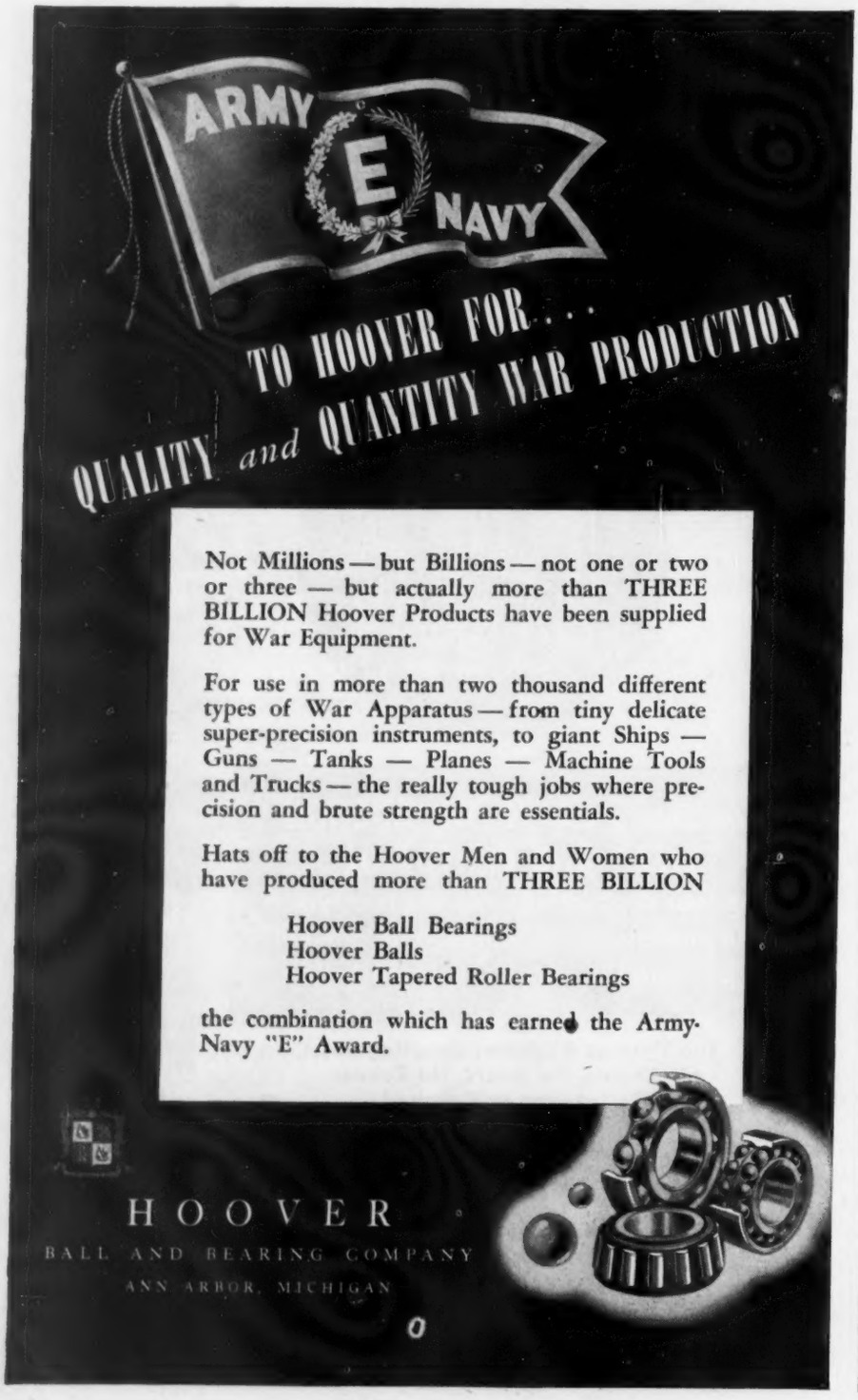
nickel-chromium-molybdenum alloy steels, including some of the NE types, is expected in the postwar era.

"The consumption of nickel in brass rolling mills has gone principally into the production of cupro-nickel products used in marine construction, with small amounts also being employed in brass and bronze compositions. Nickel has not been available during the war for use as coinage, either in its pure state or alloyed with copper, and it has also been restricted for most uses of nickel silver, both of which applications should enjoy rapid recovery as soon as nickel becomes available for non-war usage.

"More than 8 per cent of all the nickel consumed throughout the world in the year preceding the war is estimated to have gone into electroplating. All decorative applications of plating have been discontinued under war conservation measures. Consequently the consumption of nickel for electroplating has been cut down to a fraction of its prewar use and confined to the most essential of military applications where nickel coatings are required for functional rather than decorative purposes. When materials are released for general civilian consumption, it is expected more nickel will be used for electroplating.

"War production of rolled nickel, monel, inconel and other high nickel alloys at International Nickel's plants in the United Kingdom and at Huntington, W. Va., in the United States, is expected to be substantially more this year than in 1943. The level was about twice that of 1937, when the highest peacetime level was reached. These nickel alloys are used in the equipment of the Army, Navy and Air Forces as well as for equipment in other war plants. The Allied armies are considerable users of these nickel alloys, but the largest amount produced goes to the Allied navies, which have been substantial peacetime customers. Cupro-nickel, used extensively in pipe and tubing for naval construction, continued at a high rate of production this year. Military airplane production has made a large demand for inconel and '18-8' stainless steels."

In conclusion, Mr. Stanley said that "while International Nickel has given attention to the development of new peacetime products this work has definitely been subordinated to the task of keeping war production at the highest possible level. Research work carried on in the past few years in behalf of vital war efforts will direct the stream of nickel and nickel alloys from war machines and munitions to new uses in the greater realm of peace."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Expect Private Industrial Construction Gain in 1945

Private industrial construction in 1945 will exceed public industrial construction for the first time since 1940, it was predicted at a meeting in New York of the Producers' Council recently. Basing the prediction on postwar estimates of industrial construction prepared by the Market Analysis Committeee of the Council, Charles E. Young, economic research supervisor of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., said there is expected for 1945 a decline from 1944 of about 13 per cent in total industrial construction, from an estimated $845 million to a projected $735 million.

Mr. Young doubts that the war plants the government will offer for sale will have a serious effect on private industrial construction.

Report on Postwar Outlook Available to Businessmen

A 32-page study of the postwar outlook, a dollar-and-cents breakdown of the potential for United States peacetime economy, has been completed by Consolidated Management Consultants, industrial engineers, 521 Fifth avenue, New York.

By gearing themselves to make up immediately for a $65 billion gap when the wartime production program is canceled, and aiming for a national product of $175 billion in 1947, CMC asserts, American business can maintain present total war boom production levels undiminished when total peace returns.

1944 Use of Iron and Steel Scrap Was Practically at All-Time High

IRON AND STEEL scrap was rarely page one news in 1944 as it was in the two preceding years, because there was no necessity for salvage drives, yet it continued to be one of the most important raw materials for the war effort and consumption was practically at an all-time high, reports the Institute of Scrap Iron and Steel.

Based upon United States Bureau of Mines' reports, with the closing weeks of the year estimated, the institute reports that total consumption of scrap in 1944 was approximately 54,876,000 gross tons, so close to the 55,045,000 gross tons melted in 1943 that it will require final figures to determine which year was the higher.

These 54,876,000 gross tons of scrap were charged with an estimated 54,796,000 gross tons of pig iron into steel furnaces and foundry cupolas to make new iron and steel of all kinds. Hence, it continues to be true that one-half of all materiel of war made from iron and steel, such as guns, shells, ships, tanks, and motorized equipment, is made from scrap.

The consumption of scrap in 1944 included 23,324,000 gross tons of the purchased or open-market kind, principally supplied by dealers, while 31,552,000 tons were so-called home scrap, that is, scrap generated in steel mills and foundries in the various processes of manufacturing and consumed on the premises. This represented a fractional decline from 1943 for purchased scrap and an equivalent increase in home scrap.

Scrap Loss Averages 15 Per Cent

Of the 23,324,000 gross tons of purchased scrap melted in 1944, about 8,500,000 tons originated in metalworking plants as the by-product or waste of various fabricating processes. On the average, about 15 per cent of all finished steel winds up as scrap in various processes of fabrication and manufacturing, although in the case of some materiel of war the processing loss exceeds 60 per cent.

From the railroads in the shape of rolling stock junked and track material replaced came approximately 3,300,000 tons of purchased scrap in 1944.

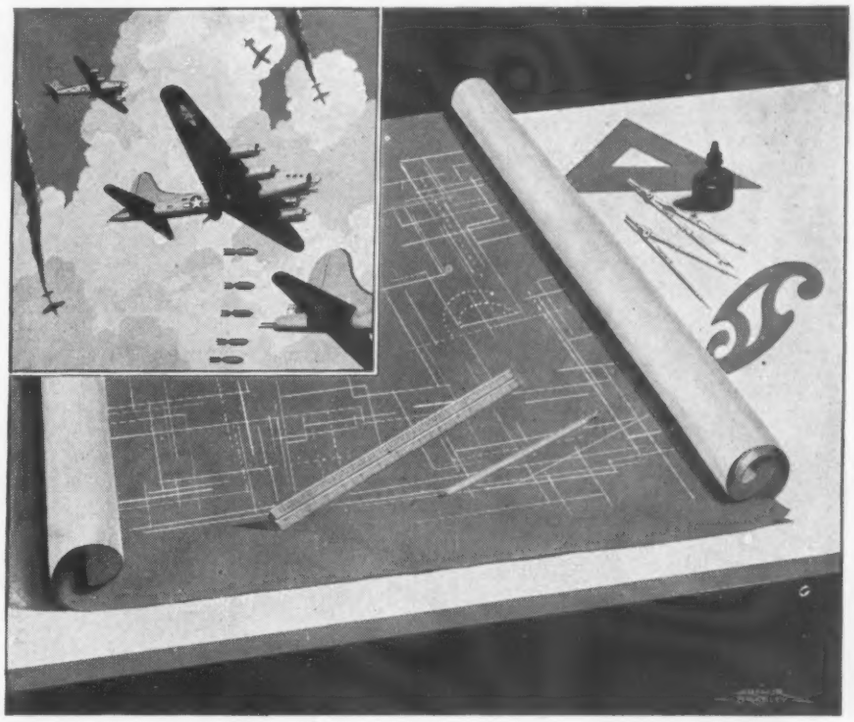
Excepting about 500,000 tons taken from inventory, the remaining 11,000,000 tons of purchased or open-market scrap consumed in 1944 originated with scrap dealers in their routine collections from farms, city residences, public utilities, city dumps, auto graveyards, and other normal sources. In addition, scrap dealers processed a substantial proportion of the 11,800,000 tons of scrap which originated in factories and on railroads.

The war job of the iron and steel scrap industry far eclipses any previous effort. In 1917, peak year of World War I, total consumption of scrap at 26,800,000 gross tons was slightly less than one-half of the volume of 1944. In 1937, the record peacetime year, the consumption of 38,000,000 gross tons was only 70 per cent of the 1944 record.

Since Pearl Harbor 163,600,000 gross tons of iron and steel scrap have been used in steel mills and foundries to make new iron and steel of all kinds. For all practical purposes, every ton of scrap melted replaces one ton of pig iron, and to make one ton of pig iron requires 3½ tons of iron ore, coal, and other raw materials. Hence, the use of scrap since Pearl Harbor alone has conserved over 570,000,000 gross tons of natural resources.

27 Bridge Projects Are on New York's Postwar List

Long needed replacements or improvements of bridges demanded by increased traffic will add 27 projects to the postwar construction program of the New York city department of public works according to Anthony J. Daidone, supervising architect of the department.



Planning for Peacetime Industry *NOW*... and Maintaining War Production *100%*

Aircraft Mechanics, Inc., while maintaining full manufacturing schedules in war production, has planned a two-point post war program: (A) We will continue to offer design, engineering, and manufacturing facilities and skill as sub-contractors in the aviation, automotive, oil refinery and equipment, and other industrial fields. (B) We will manufacture several items of our own design for general distribution.

We presently are serving more than 50 major aircraft manufacturers, as well as leading concerns in other metal working fields, in the production of high tensile steel forgings and welded tubular assemblies. An inquiry, today, will bring you immediate details of our ability to serve you, too.

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Steel Products Are Improved by Research in 1944

IMPORTANT ADVANCES in both fundamental research and in relating research findings to specific improvements in steel products were made in laboratories and in the plants of subsidiary companies of United States Steel Corp. during 1944. While many of the studies concerned steel for war uses and the results of these investigations must remain secret temporarily, numerous other results are of a general nature which will be of value to the entire steel industry, as well as to the users of steel.

Early in the year United States Steel researchers issued an Atlas of Isothermal Transformation Diagrams greatly extending and illustrating graphically the fundamental principles of steel heat treatment. This publication was widely acclaimed as a valuable contribution not only to the war effort but to the general advancement of the art and science of heat treatment. Additional work on the mechanical properties, hardenability and isothermal transformation diagrams of numerous NE steels has now been completed and studies are being continued further on heat treatment for specific needs.

New data are expected shortly in connection with the development of high grade tensile steels, and a vast amount of effort has been devoted to forging and machining. The results of these studies remain restricted, but are expected to be made available in the near future to the manufacturers of steel products.

Researches have been continued on the use of intensifiers, such as boron, and on hardenability. Work on electrolytic tin plate and other coatings for steel sheet, strip and wire has made great strides. New pickling practices have been perfected, and some of the perplexing problems relating to waste pickle liquor have advanced toward solution.

Much practical research on deep drawing was performed in connection with the steel cartridge case program and these results will be of value to civilian industry when steel again becomes available for peacetime uses. Advances have also been made in the manufacture of steel sheet for enameling.

Spectrographic equipment is now in standard use in several United States Steel plants as a result of recent development work, and advances have been made during the past year in the further application of pyrometry to open hearth, electric furnace and bessemer practice and control. Much valuable work has been done also in developing standards and improved practices for various grades of bessemer steel. As a direct result of this research, a considerable amount of bessemer seamless tubing is now being made. Perfected dephosphorizing methods have increased the utility of some bessemer grades and an increasing quantity of alloy steel is being made by the bessemer process.

Standards and Practices Improved

Standards and practices relating to NE and other alloy steels have been improved. Many steels now being used exclusively for war purposes have established a permanent place for themselves in industry as a result of recent technologic developments within the mills of United States Steel Corp. subsidiaries.

Research on fundamentals, for which the research laboratory of United States Steel Corp. at Kearny, N. J., is particularly well equipped, has been continued on a wide variety of problems and has been extended into many of the new laboratories in the subsidiary company mills. The results of these investigations are applicable not only to immediate war problems, but also to postwar products.

A satisfactory magnetic method was developed at the Kearny laboratory for inspecting steel fabricated into gas cylinders for pneumatic life rafts. Much special work on magnetic testing of steels for various purposes was also completed there and more is in progress. High temperature tests, including time-consuming creep strength studies, were continued through the year.

Among outstanding recent research achievements of this laboratory is the de-

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velopment and perfection of special equipment for testing the so-called "micro-hardness" of metals, which enables the research worker to determine with precision the hardness of individual grains or constituents of steel so small that they are visible only at high magnification under a microscope.

Various advances were made in operating practice and equipment during 1944. These contributed substantially to the continuation of the exceptionally high operating rate which has been maintained in coke, blast furnace, and open hearth operations and made it possible for open hearth operators to carry their full share of the burden imposed by the continuing demand for alloy steel. Methods were perfected to facilitate the use of alloy scrap and alloy steel turnings by United States Steel plants, and Pittsburgh district open hearth plants increased their use of nodulized ore as produced by a United States Steel plant. Additional hot-topping facilities increased the production of ordnance steels.

Improves Ingot Heating Facilities

Much progress has been made by United States Steel subsidiaries in improving ingot heating facilities and in the control of rolling temperatures so as to improve the quality of the finished product. New, high-speed rod mills were brought into successful operation at the Joliet, Ill., and Pittsburg, Calif., mills. Numerous other improvements have been made throughout all subsidiary company mills to make possible a continued high production rate while maintaining high standards of quality.

RFC Acquiring Warehouse Space for Equipment Pool

Reconstruction Finance Corp. is acquiring warehouse space in a number of industrial centers of the country where equipment may be pooled for speedy utilization, first, in war production and, second, for essential civilian needs. Inventories will be made available for inspection at these centers where war manufacturers may buy the things they need in stepping up their war production. The RFC, in co-operation with the War Department, is utilizing available existing warehouse space and, where necessary, is building additional storage.

Accident Rates for Metals Industries Are Available

Pamphlets on accident rates of 1943 for the steel industry, the foundry industry, the iron and steel products industries, and the nonferrous metal and products industry have been made available by the National Safety Council, Chicago.

For the steel industry there was a 5 per cent decrease in the average severity rate in 1943 in comparison with 1942. This was the first reduction in the industry's relatively high severity rate since 1938. The 1943 average severity rate of American industry as a whole was up 1 per cent. Results from the standpoint of frequency of injuries were less favorable in the steel industry, the average frequency rate being up 1 per cent in comparison with a decrease of 5 per cent in the average rate of all industries.

Accident prevention efforts in foundries in 1943 failed to reverse the upward trend in injury rates since the beginning of the war. That year was the third successive one in which injury rates increased over the previous year.

Safety work in the sheet metal industry was effective in 1943, the reports show. Decrease in average frequency rates was 12 per cent in comparison with 1942, and reduction in the average severity rate amounted to 22 per cent.

Injury rates of companies engaged in milling, smelting, and fabricating nonferrous metals increased steadily, on the whole, since 1939. Frequency in the 1943 rates averaged 20 per cent higher than in 1942 and the increase in the average severity rate was 7 per cent. Control over accident experience was less effective in nonferrous metals and products industry than in other metals industries, the reports show.

In resuming post-war manufacture, no buyer can afford to gamble with inferior sources of supply . . . Consequently—we urge you NOW to choose "Chicago Screw" as your source for Precision Screw Machine Products.

With our up-to-date production equipment, plus modern inspection tools and methods, backed up by 72 years of experience—we have the "Know How" for producing your toughest jobs.

Under one roof, we have complete facilities for producing the most intricate parts (or the simplest)—1/16" to 5" diameter and any length—from any type of material—in unlimited large or small quantities . . . Let our mental and physical capacity help make your post-war problems easier!

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ESTABLISHED 1872
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Materials Handling

(*Continued from Page* 301)

tion, that the conveyor industry has done a creditable job in speeding this program.

"As to what this year will bring, I feel certain that the conveyor people, especially those with large engineering facilities, will be extremely busy. The continued pressure on the enemy in all theatres of war should certainly bring many changes in the overall production picture. Responsibility for keeping war materials moving, along with help required by manufacturers with whatever reconversion materials permit should keep engineering facilities occupied.

Economic Value of Equipment, Tools, Key in Plant Planning

R. W. Mallick, section engineer headquarters manufacturing, Engineering Department, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa: "The outstanding development in the field of materials handling has been the awakening by industrial management and supervision to the real problem which materials handling presents. Management is beginning to appreciate that this function is the greatest single item of labor cost in most industries.

"Much of the tremendous advance in efficiency of production in the past decade has been achieved primarily through improved methods of materials handling, developed through the science of plant layout.

"When one realizes that the handling of a product adds only to its cost and nothing to its value, then it becomes apparent that the quicker it can be transformed from the raw material, and with the least handling, into the item the public will buy, only then will real manufacturing efficiency be achieved.

"The important task now is for our engineers to design plants capable of utilizing efficiently the economic values of these improved machine tools. One new development, three-dimensional planning, will enable plant layout engineers to design their plant layouts faster and better to more fully utilize the cubical space of the plants."

Improved Units Move 4 Times Prewar Tonnage with Half Crew

Lester M. Sears, president, Towmotor Corp., Cleveland: "War has proved that the movement of materials is a function of tremendous importance. This recognition assures materials handling of an increasingly prominent place in peacetime production.

"Spurred by incessant demand, all operations contributing to production have been studied, surveyed and stop-watched. The savings in time, manpower and cost provided by modern mechanical handling methods have convinced most executives in metalworking that use of these methods is essential to efficient operation.

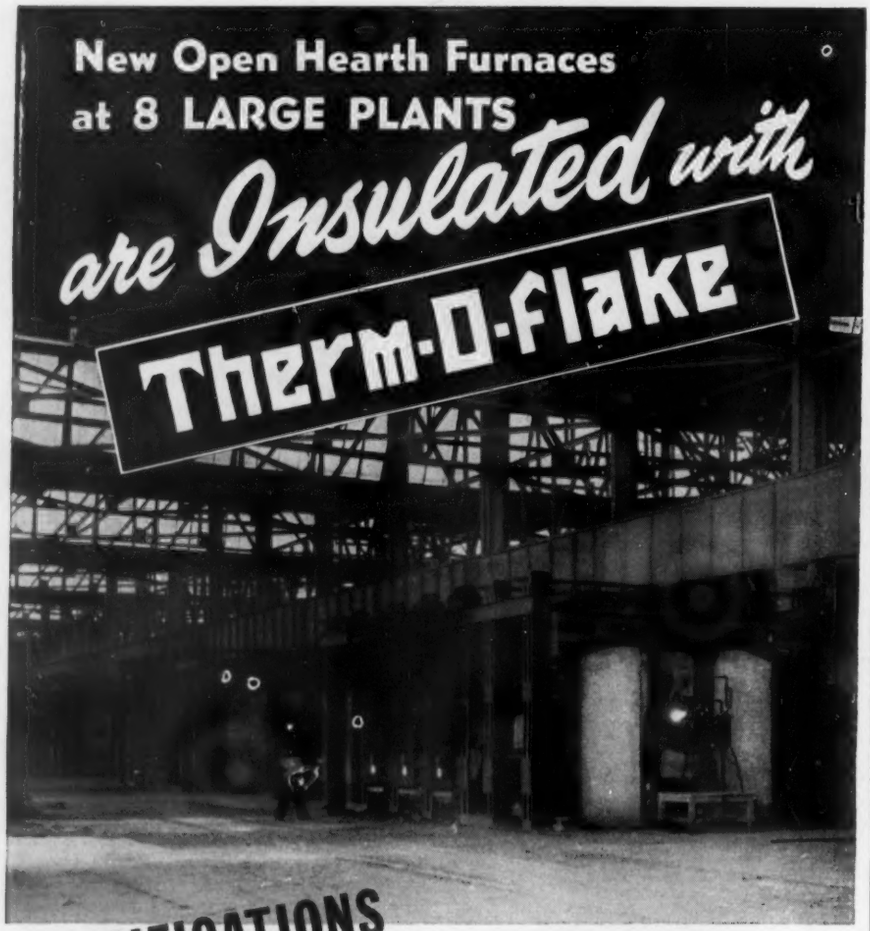
"It seems to us significant that reports are continually reaching us from Army and Navy users speaking of as high as 400 per cent increases in tonnages handled per manhour, and as much as 200 per cent added to the storage capacities of floor areas by fork lift trucks.

"Likewise, we hear glowing reports from war production plants. For example, one plant producing hobbing machines is handling four times its prewar tonnage with half the manpower and half the cost; another producing brass ordnance and allied products has effected a 90 per cent manpower saving on one important loading operation.

"These are only a few instances of many regularly encountered which indicate clearly that industry is only beginning to become cost-conscious where handling operations are concerned."

Reverse Flow of Surplus Units Into Factory's Hands Endorsed

C. B. Cook, vice president, Elwell-Parker Electric Co., Cleveland: "Power industrial trucks have been considered through 1944 as critical equipment. These



SPECIFICATIONS
for Greater Fuel Economy
Improved Working Conditions

Therm-O-Flake Coating Vertical walls — bulkheads — roofs — arches.

Therm-O-Flake Brick Flue Walls and Arch — Checker Chamber Walls. Slag Pocket Walls.

Therm-O-Flake Concrete Flue — Checker Chamber Hearth Bottoms.

Illinois Clay Products Company
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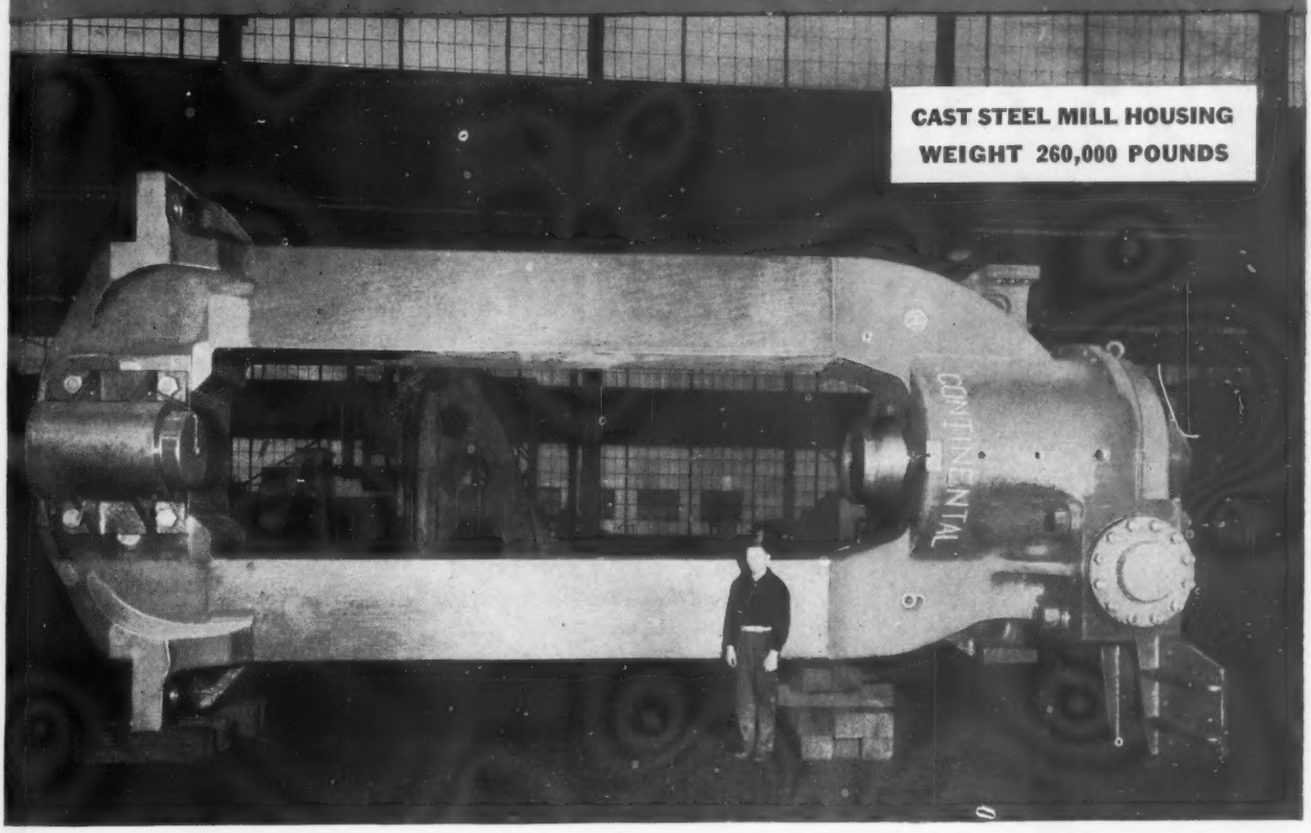
High Temperature INSULATION

CONTINENTAL

CARBON AND ALLOY STEEL CASTINGS



ARMY E NAVY

Continental Products—

Carbon and alloy steel castings . . . Carbon steel, alloy steel rolls . . . Iron and alloy iron chill rolls . . . Rolling Mills and steel plant equipment . . . Special Machinery.

CONTINENTAL

FOUNDRY & MACHINE COMPANY

CHICAGO . PITTSBURGH

CHICAGO WORKS, *East Chicago, Indiana*
PITTSBURGH WORKS, *Coraopolis, Pennsylvania*
WHEELING WORKS, *Wheeling, West Virginia*
WARWOOD WORKS, *Wheeling, West Virginia*

trucks have been distributed here and overseas and are now appreciated as a useful tool to save time and manpower.

"Much attention has been given toward aiding in shaping plans for disposal of surplus war goods including power industrial trucks, power batteries and power battery chargers. There is considerable sentiment favoring reverse flow of surplus back through the original supplier and into normal markets. These suppliers have their own sales staffs, can locate the greatest number of buyers, can secure the fairest price and they will guarantee and certify the product. Some manufacturers have offered to market at least 10 per cent of their current production from their surplus manufacture."

Labor Shortage Accentuates Value of Handling Equipment

F. J. Shepard Jr., treasurer, Lewis-Shepard Products Inc., Watertown, Mass.:

"Continuing labor shortage, especially of the husky type needed for materials handling, has sharply increased the demand for materials handling equipment and we expect this trend to continue.

"Where women and inexperienced men are the only available help for this class of work, the use of proper equipment will enable them to handle a much larger tonnage per operator.

"The lift truck-platform system, which eliminates rehandling and enables an operator to move larger loads without increased effort, is the remedy for bottlenecks in moving materials.

"Increased inventory which must be stored on the same floor space demands the use of portable elevators and power fork trucks, and by piling to greater heights, without increased labor present storage space may be doubled or trebled."

Explosion-Proof Fork Truck To Serve Plants for Inflammables

D. L. Darnell, manager, sales engineering, Baker-Raulang Co., Cleveland:

"Although the industrial truck industry is unquestionably looking forward to the postwar era yet it has been impractical to do more than make paper plans because the entire output of the industry is still required for the war effort.

"Probably the most important development was the explosion-proof fork truck to provide a safer means for handling the more hazardous types of ammunition. This is a standard electric fork truck with all of its electrical equipment specially housed and specially protected so trucks may operate safely in explosive atmospheres or in the vicinity of highly explosive materials.

"Trucks and tractors of the explosion-proof construction will have applications in the postwar market in chemical plants, oil refineries, coal mines and in other industries where explosive or highly inflammable materials are encountered."

Useful Segments of Handling Cycle for Cranes Important

J. W. Wunsch, consulting engineer and president, Silent Hoist Winch & Crane Co., Brooklyn, N. Y., and Milford Crane & Machine Co., Milford, Conn.: "The time of materials handling in many manufacturing and processing operations is too often all but the entire cycle. This nonproductive 'overhead' loss which material handling bears to productive labor, by an interesting analogy points to a glaring deficiency in materials handling means and methods. Applying this thought, by way of illustration, to the industrial crane, we find that we take far too much time in preparation and incidental operations in ratio to effective materials handling. We must keep in mind that the 'useful' segments of the cycle are when load is rising or being transported. Incidental operations must be reduced."

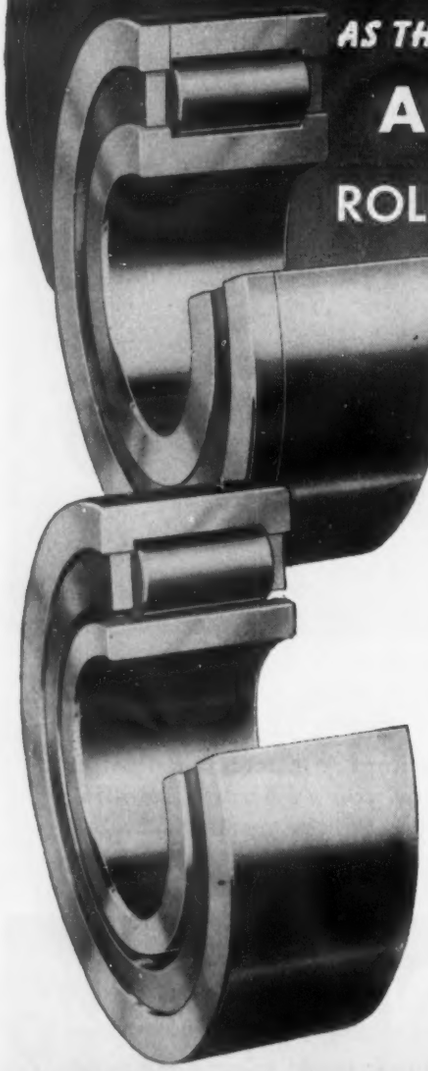
DEPENDABLE

AS THE NAME THEY BEAR

AMERICAN

RADIAL

ROLLER BEARINGS



Engineered specifically for extra heavy duty applications where the load is *radial*, AMERICAN RADIAL ROLLER BEARINGS function smoothly and dependably under the most exacting service conditions. Specialized construction, flawless materials and precision manufacturing, set them apart as *the most dependable bearings yet designed* for radial loads where strains are greater . . . where toughness, super-strength and smooth, continuous, trouble-free performance are absolute requisites.

AMERICAN RADIAL ROLLER BEARINGS are made in 5 styles, 4 S.A.E. series and 85 sizes. Special designs to order are also available. Write for complete data or send us your requirements for analysis and recommendations.

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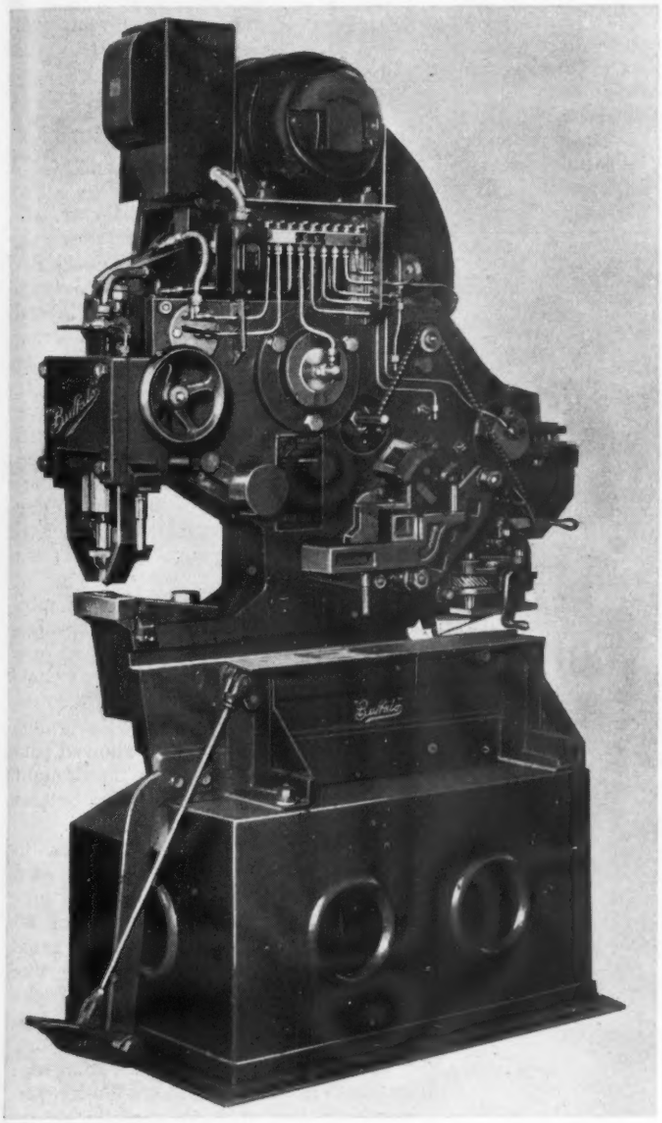
AMERICAN ROLLER BEARINGS HEAVY DUTY

AMERICAN

Heavy-Duty ROLLER BEARINGS

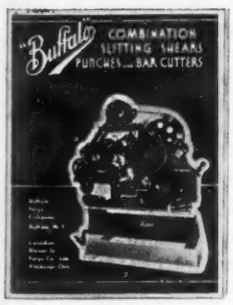
This Machine "Cuts Corners" in Thousands of Factories



Literally and figuratively, Buffalo Universal Iron Workers are cutting production and cost "corners" in thousands of metal working factories all over the world.

Built in seven sizes, plus some models with variations from standard, the Universal Iron Worker has punch, shear and bar-cutter incorporated in one machine, driven by one motor. Shear cuts flats and plates, bar cutter cuts rounds, squares, angles, tees; with special blades will handle other shapes. Punch puts accurate holes in any material up to capacity of the machine.

When you put a "Buffalo" Universal in your plant, you're ready for a real days work—every day!



Write for Bulletin 360A which gives complete specifications and capacities

Buffalo Forge Company

158 Mortimer Street **Buffalo, N.Y.**

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo"

Universal Iron Worker

Iron-Steel Production

(*Continued from Page* 268)

duction cost. This is one of the important jobs for the future. We must individually and collectively find the solution."

Increased Interest Shown in All-Basic Construction

Louis A. Smith, refractories engineer, Jones & Laughlin Steel Corp., Aliquippa, Pa.: "The all-basic open-hearth furnace in this country is strides ahead of where it was a year ago. Shops which had basic port ends are considering adding basic main roofs; the shop with two main roofs of basic brick appears ready to add basic ends.

"Attention being paid to the alumina content of silica brick is growing. Enough correlation of alumina with roof performance had been done to convince even the 'die-hards' that no matter how good the roof has been nor how difficult it may be to effect improvement, more effort should be made toward keeping alumina down.

"One of the most interesting items of the year just closed was the complete roof of mullite brick in a full sized open hearth. While the actual run was not as good as silica brick because of certain mechanical weaknesses, another trial will be made.

"Quick-setting, easily placed, time saving bottom materials gained in prestige in the past year. If the present trend of events in this direction meets with no serious setback, perhaps the time-losing, heat-consuming bottom making procedures of more than 50 years will have been quietly consigned to the limbo of lost arts."

Use of Ramming Mixtures for Furnace Bottoms Increases

Fred A. Harvey, director of research, Harbison-Walker Refractories Co., Pittsburgh: "Experimental work which is being done in an effort to apply basic brick to open-hearth furnace roofs is showing much promise. Special basic brick produced for this purpose by the leading manufacturers are being tried both in sprung arch roofs and in suspended roofs. Evidence indicates that some of these roofs will be successful.

"Use of high-magnesia ramming mixtures for open-hearth furnace bottoms has shown a substantial increase. While previously used materials of this type composed of dolomite and magnesite require a top dressing of magnesite grains, these new materials have allowed the dense, rammed material to be brought up to the final contours of the bottom without further dressing.

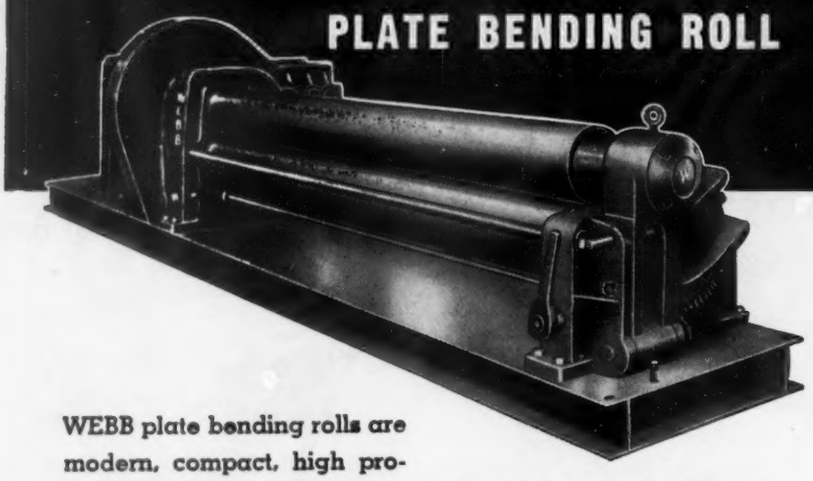
"Use of super duty silica brick in open-hearth furnace roofs has increased as rapidly as the manufacturer could supply the brick. Increases in life of 15 to 30 per cent are reported in some plants. To supply the demand for this type of refractory, the owner of the patent has offered to license other reputable manufacturers.

"Installation of a heavy media separation unit for handling Washington magnesite has at least partially solved the manpower shortage problem in this industry. In addition, the product shows much greater uniformity. It has been possible to meet the unprecedented demands for dead-burned magnesite and it is of interest that the United States production in 1943 was approximately equivalent to the total world production in any prewar year."

Ramming Mixtures Reduce Time of Hearth Installation

T. W. Shook, director of refractory engineering, Basic Refractories Inc., Cleveland: "Wartime demands have not only strained steelmaking operations to an unprecedented level, but higher quality standards have been imposed. The adoption of a cold ramming magnesia refractory, for new hearth construction and major repairs in basic open-hearth

Modernize
AND SPEED UP YOUR PRODUCTION
WITH A WEBB
PLATE BENDING ROLL



WEBB plate bending rolls are modern, compact, high production machines. Made in a complete range of sizes and capacities, these rolls are being used on high quantity production rolling in all types of metal shops throughout the United States. These rolls are made in both pyramid and pinch types.

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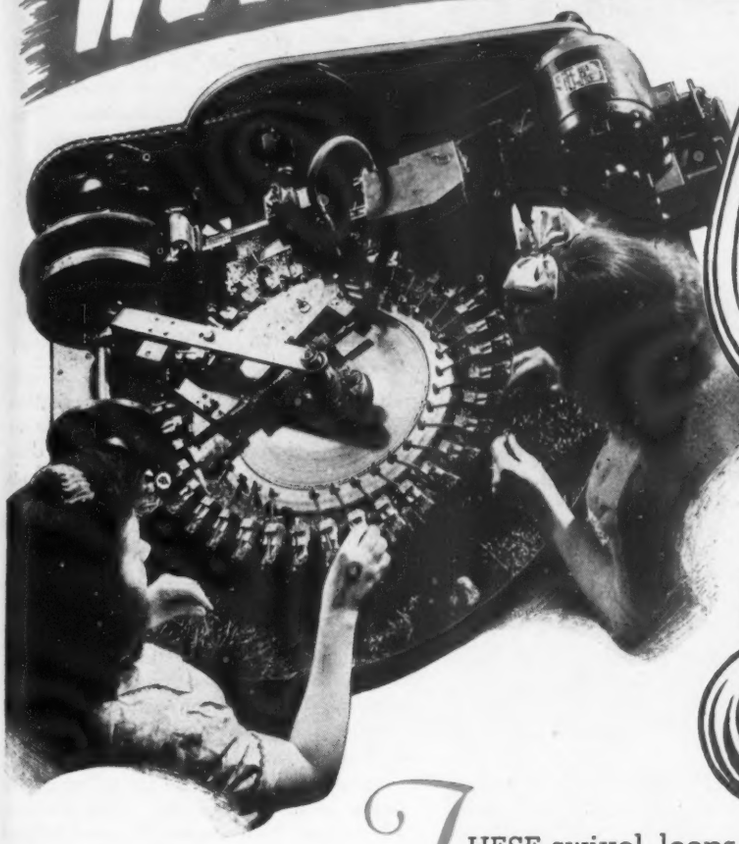

THESE swivel loops are essential to certain devastating projectiles. Here at Accurate, special forming and testing equipment were designed and built to produce them in the vast quantities needed, and to the rigid specifications required.

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SPRINGS
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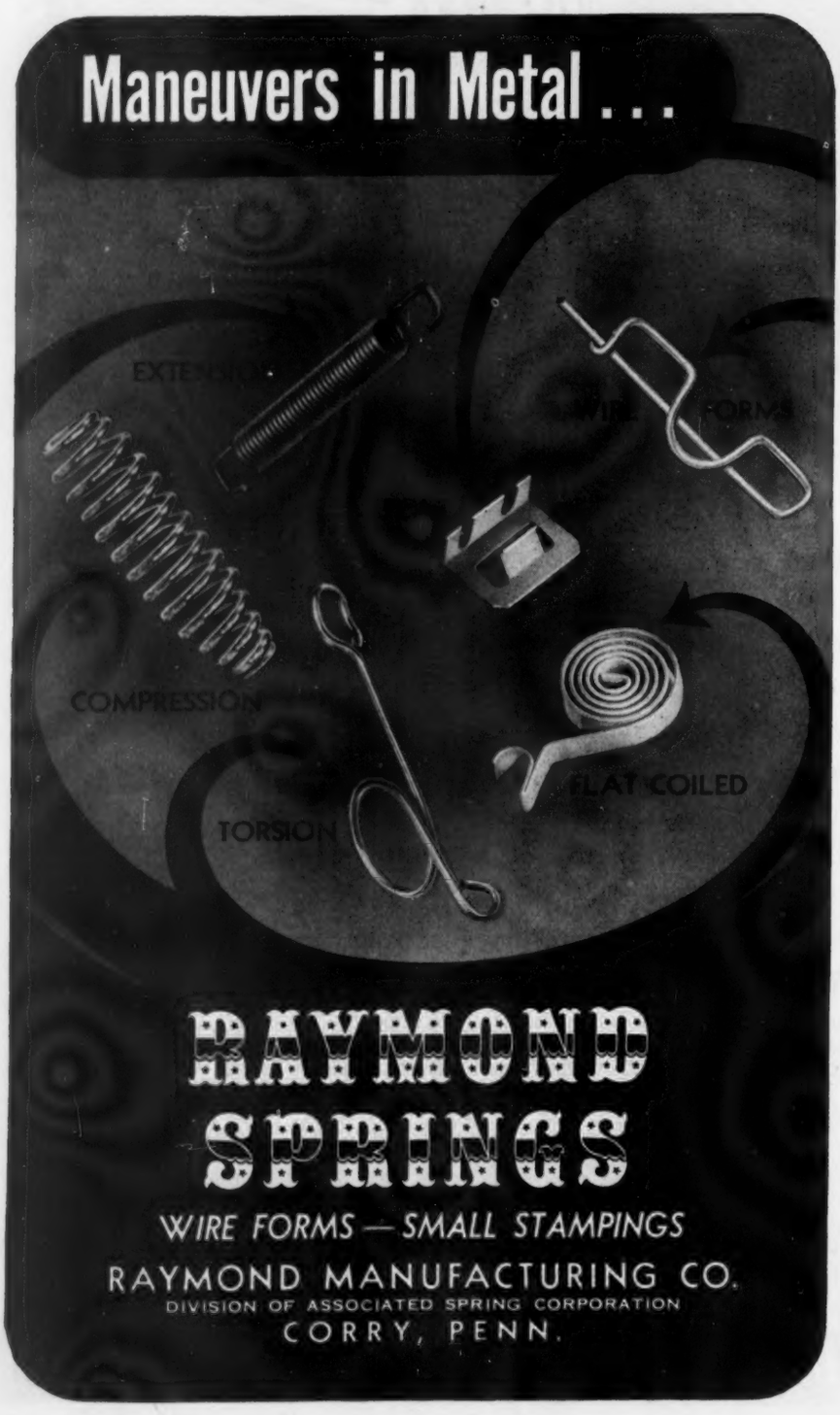
and electric steel furnaces, has done much to enable operators to meet these demands.

"Cold ramming of the refractory takes only a few hours, even in the largest furnaces, thus eliminating the slow, laborious burning in of the many layers of magnesite required in previous conventional hearth construction. Shorter installation time with less skilled labor has aided in materially increasing steel production at lower costs. This has encouraged more frequent replacement of hearths with better steel quality resulting.

"The trend of thought now indicates a policy of replacing hearths when delay time disrupts furnace and related mill schedules, and quality becomes jeopardized. The smooth functioning of steel producing and rolling facilities demands meeting heat specifications and production schedules. Sound, reliable hearths, properly maintained, will contribute much to meeting this end.

"Increased electric furnace life is now being obtained by the use of Gunmix applied through a pneumatic gun. The lining life has not only been increased but previously inaccessible areas can be maintained by hot repair with this type of application, with resulting refractory savings and increased tonnage with lower operating costs."



Two All-Basic Open Hearths Now Under Construction

R. P. Heuer, vice president, General Refractories Co., Philadelphia: "Interest in the all-basic open-hearth furnace was spurred by developments in 1944. Four new furnaces were put in operation. Two of these are entirely basic except for the main roof which is silica. The port roof, the furnace side of the uptake and portions of the uptake sidewalls and endwalls are suspended construction. Experience to date on a 180-ton furnace is as follows:

	Basic Furnace	Shop Average
Tons per hour (Tap to tap)	15.50	14.00
Avg. time of heat, hrs.-min.	10-55	11-45
B.t.u.'s per ton	3,300,000	3,400,000

"Slag pocket accumulation is easily removed while the furnace is in operation and is of a quality suitable for use as blast furnace sinter. The amount of dust accumulating in the checkers and flues is less than half of that in the case of silica brick.

"Results have been such that a basic main roof will be installed.

"The program to date has involved three types of arch construction—sprung, suspended and sprung reinforced with steel work, two types of vertical wall construction—conventional built-up and sectionally supported and 10 types of basic brick.

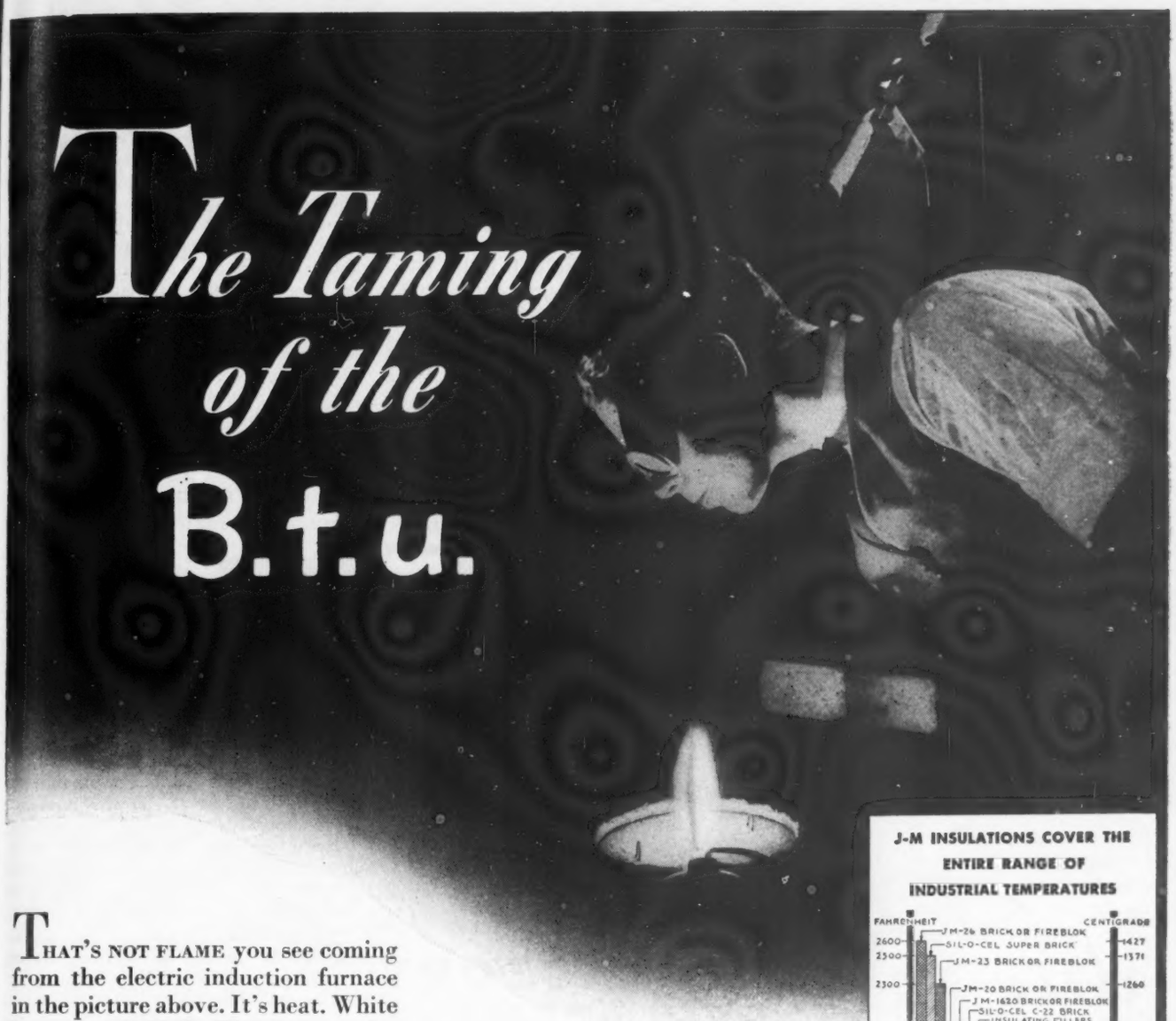
"Experience gained so far is leading to better evaluation of the basic furnace advantages, new types of construction and improved refractories. Two completely basic furnaces are expected to be in operation in 1945 and these should add materially to the subject."

Coal Washing Improves Blast Furnace Coke

C. D. King, chairman operating committees, United States Steel Corp., Pittsburgh: "Perhaps the greatest single problem common to all operating departments has been that of manpower, and while management and labor have co-operated in trying to solve it, it continues to remain the major problem.

"In by-product coke plant operation, deterioration in chemical composition of some present as well as future coals has led to the consideration and installation of coal washing plants which should tend to improve the operating conditions of blast furnaces using coke produced from such coals. Increasing attention is being given to methods of controlling the bulk density of coal as charged, to improve physical uniformity of coke.

"In blast furnace operation, attention is focused largely on the importance of



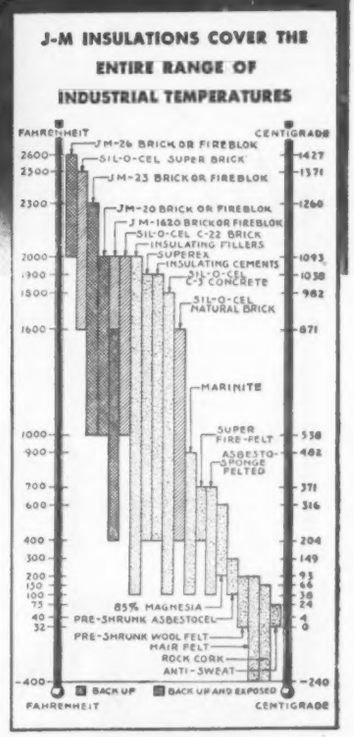
The Taming of the B.t.u.

THAT'S NOT FLAME you see coming from the electric induction furnace in the picture above. It's heat. White heat, at 3200° F. This is one of a score of tests performed in the Johns-Manville Research Laboratory—a part of J-M's continuing effort to control more completely the flow of heat.

During the past 27 years, history-making progress in developing more efficient insulation has been made in this laboratory—the largest of its kind in the world. Here, some of the most baffling problems in heat-flow and its measurement have been solved. Here, too, J-M Scientists have devised a number of insulations, each designed to do a certain job . . . from minus 400° to 2600° F.

This unequaled assortment of insulating materials is available to you. And trained Johns-Manville Insulation specialists, plus the facilities of the J-M Research Laboratory, are available to help you with your particular heat insulation problems.

For the full story on J-M Insulations and Refractory Products for the power plant, write Johns-Manville, 22 East 40th Street, New York 16, New York.



JOHNS-MANVILLE JM PRODUCTS

Johns-Manville
INDUSTRIAL INSULATIONS
FOR EVERY TEMPERATURE . . . FOR EVERY SERVICE

uniformity of raw materials and in some cases accompanied by their beneficiation. A further step in the control of uniformity of operation takes the form of experimental application of moisture to the blast.

"Open-hearth ingot production continues at high levels, although increasing difficulties are being encountered in rapid rebuilding of furnaces due to labor shortages. The use of prepared charge ores, permitting the use of increased pig iron charges, has materially improved operating conditions at many plants as well as alleviated the scrap situation.

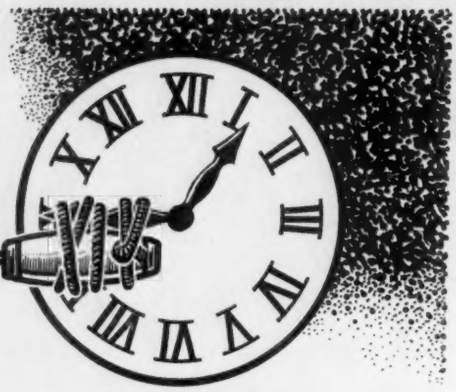
"Triplex processes continue to play a part in electric furnace steel production."

Improves Quality of Silica Brick for Open Hearths

S. M. Swain, director of research, North American Refractories Co., Cleveland: "Much interest has been shown this past year in improvements in quality of silica brick, particularly for open-hearth roofs. The consistently higher operating temperatures of the war period have made it more economical to use superior grades of silica low in all impurities. Much effort has been expended by manufacturers and considerable success obtained in finding methods of selecting raw materials to produce these superior brick.

"This interest in better silica brick has resulted in investigations of superior silica mortars to be used with them. It has been customary in the past to use silica fire clay which has been equally unsatisfactory to the producer and consumer alike because of the close balance between refractoriness and workability. There have been developed and are available silica mortars containing little or no clay or other alumina bearing ingredients and possessing both high refractoriness and good workability. These mortars are finding extended use not only in open-hearth roofs but also in coke ovens, glass tanks and other furnaces built of silica brick."

REDUCE LOST TIME due to REFRACTORY REPLACEMENT



The labor and materials used for refractory replacement are a terrific drag on production time. You can retrieve these wasted hours by eliminating the cause—and the best way is to USE GLOBE SUPERIOR LADLE BRICK. Wire cut or dry pressed, they will bring about CLEANER STEEL, LOWER PER TON BRICK COST, and SAVE TIME LOST IN REFRACTORY REPLACEMENT.

SERVING THE STEEL INDUSTRY SINCE 1873

The GLOBE Brick Co.

EAST LIVERPOOL, OHIO

Life of Pig Machine Molds Depends on Many Factors

H. P. Bailey, chemical engineer, Moores Lime Co., Springfield, O.: "Coating pig machine molds is an art requiring a special material designed for the job and tested by years of use. Good mold life usually is considered about 250 tons of pig iron per mold. When a mold burns, the source of the trouble is the coating and its method of application. Cracked molds usually are attributed to the coating, method of water cooling the molds, mold analysis and design, or a combination of these.

"Elimination of stickers is accomplished by the use of a coating having satisfactory adhesive and insulating properties uniformly applied across the face of the mold. Common practice in the case of nonmerchant is ⅛-inch.

"Smooth top pig iron is obtained by using a mold coating free from gases.

"Hot metal should have little or no affinity to react chemically with the coating."

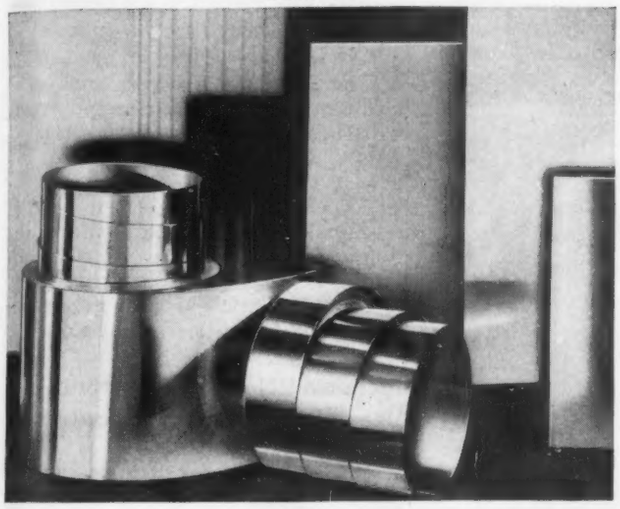
New Special Purpose Mill Temper Rolls Cold Strip

G. G. Beard, vice president, United Engineering & Foundry Co., Pittsburgh: "Tremendous demand for steel plates and aluminum sheets at the start of the war resulted in the installation of several large rolling mill plants. Since then considerable thought and study of the art has resulted in the development of special purpose mills.

"Outstanding among these is the unitemper mill for temper rolling of cold-reduced strip for a wide variety of uses. This mill is capable of producing great temper hardness combined with satisfactory ductility to a degree heretofore unobtainable.

"The postwar period will be one of specialties so that we may expect several types of rolling mills designed for the production of specialty products."

DO YOU SEE WHAT WE SEE



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Established 1898
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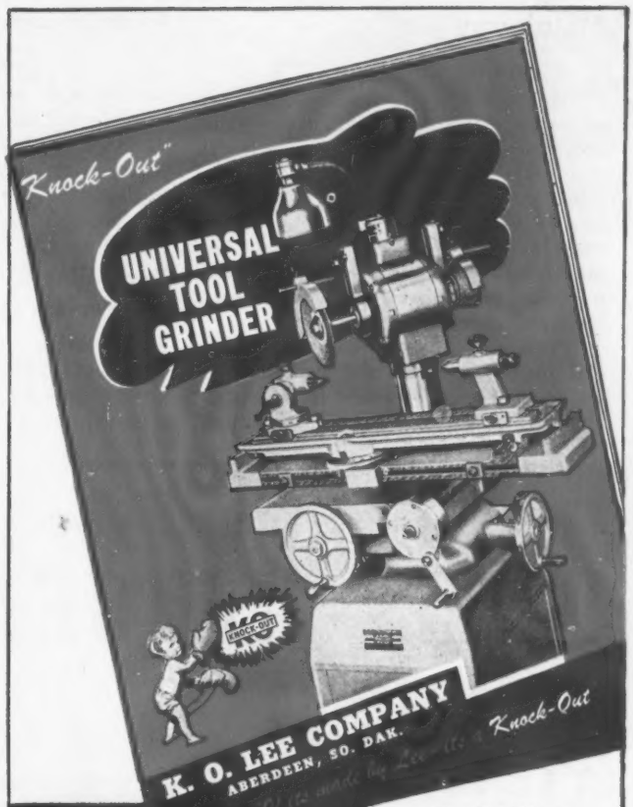

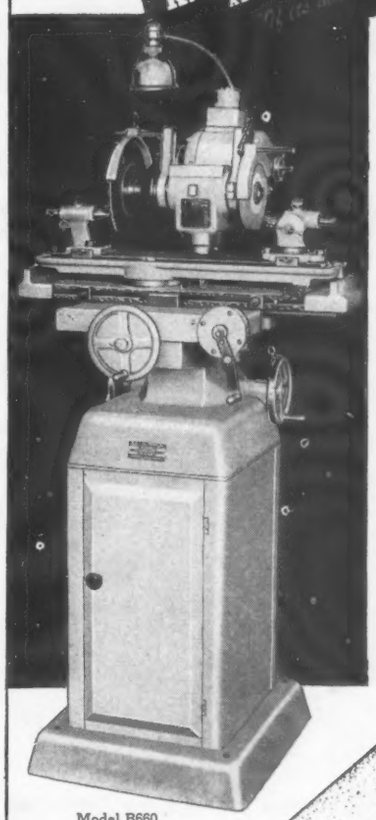

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Metallurgy

(*Continued from Page 277*)

"The end quench hardenability test as we know it today fulfills this need in an apparently satisfactory manner. It may well be that in the near future these same hardenability results could be analyzed more critically with an eye toward predetermining not only the quenching capabilities of a steel but also response to tempering and expected structural characteristics as well.

"From our present day knowledge and experience with the hardenability qualities of certain steels, it is reasonable to expect that certain limitations for the commercial production of such steels should be in order. At this writing we have such commercial limitations for the 4100, 8600 and 8700 series of steels in all carbon ranges and also for the SAE 4620 and 4340 steels. It is expected that similar limits for additional steels will be proposed in the very near future.

Dual-Alloy Composition Tested For Service in Engine Bearing

E. R. Darby, director of research, Federal-Mogul Corp., Detroit: "The expansion in the light metal industry has been phenomenal and so well have those industries done their work that curtailment in production has already become necessary. One of the alloys which will probably stay with us when the war is over is the aluminum-tin composition being widely tested for internal combustion engine bearings. It has given considerable promise as a one-piece bearing and, with the development of bonding it to steel, may create a demand in the automotive field.

"Porous metal bushings, gears, small ordnance parts, are now being made from ferrous powders, and copper-lead bearings with steel backs are being made from strip produced by the mile.

"Use of electrochemical methods in bearing production has been emphasized in the past 2 years. Steel-backed silver-lined bearings are one outstanding example. The practice of over-plating the bearing surface with one-thousandth or less thickness of lead or an alloy of lead is becoming standard where the bearing metal must be selected primarily for high endurance characteristics. Improvements in plating methods have made heavy plates practicable."

Increased Need for Structural Uses of Magnesium Imposing

Zay Jeffries, technical director, Lamp Department, General Electric Co., Nela Park, Cleveland, O.: "One of the great achievements of recent years, especially from the standpoint of quality, is the expansion in the production of alloy steel. Electric steel furnace capacity alone is now about 5,000,000 tons a year, or around three times that of prewar. The total alloy steel capacity is about 15,000,000 tons.

"One reason for the higher production is the extensive use of the NE steels.

"The effect of the war on the light metals aluminum and magnesium has, perhaps, been the most sensational. The dislocations from peace conditions have been great as compared with the other common metals.

"The magnesium expansion is unusual, partly because vast quantities were required for purposes other than structural, namely, for incendiaries and pyrotechnics. The increased need for its structural uses is, however, imposing. It helps to make aluminum alloys stronger and, when used as magnesium-base alloys for certain aircraft parts, there is a saving in weight.

"One of the interesting features of the expansion program was the use of the ferrosilicon reduction process. Most of the increase was effected by the conventional process, including sea water as one source of raw material. Direct current electricity is required for this process. Because of the upped aluminum program, which also required direct current, it appeared that there would not be enough direct current to make the re-

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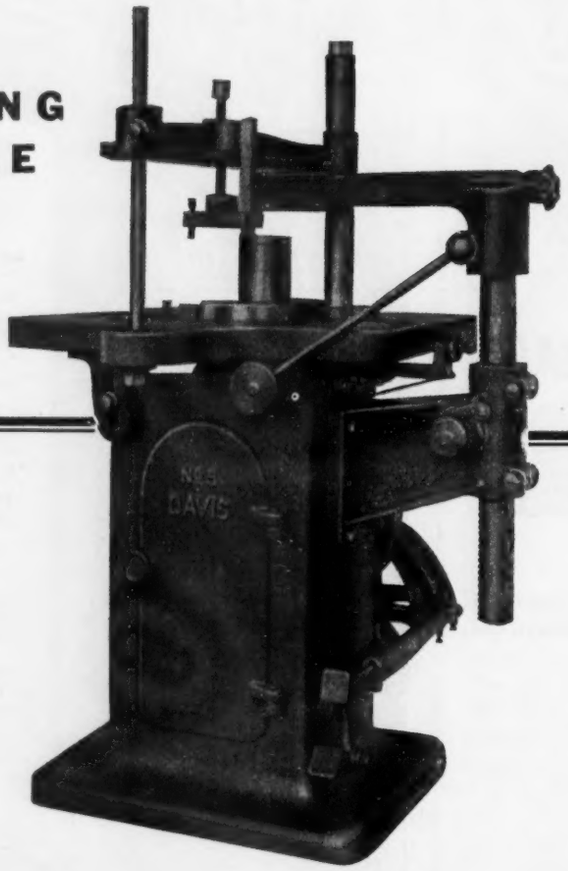
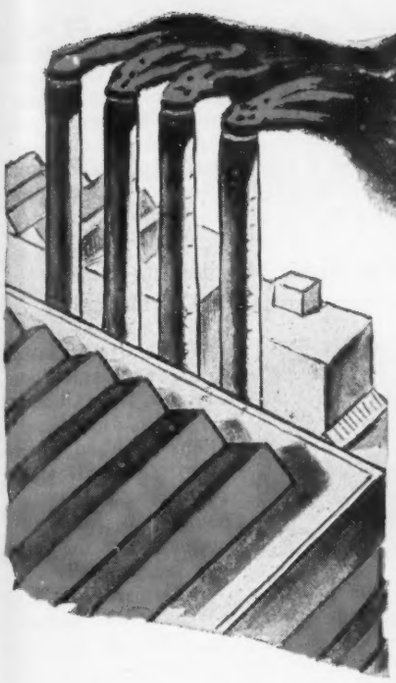
with
TILTING TABLE



• Taper keyways may be cut by inclining table in either direction from horizontal. Scale indicates exact taper per foot. Cutter operates in vertical position, with resistance arm adjusted to different cutters. Table-type feed with adjustable feed stop.

DAVIS KEYSEATER CO.
397 EXCHANGE ST. ROCHESTER 8, N. Y.



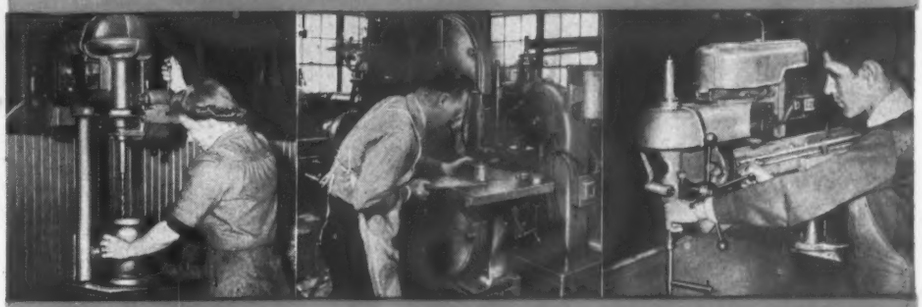
DON'T LET PRE-WAR METHODS KILL POST-WAR PROSPERITY!

The war years have proven to American Industry that the light machine tool has an important place in Production. Walker-Turner machine tools have demonstrated their ruggedness under most exacting conditions.

Don't let pre-war operating methods affect your post-war competitive position. The versatility of Walker-Turner machine tools will ensure production equal to—and, in many cases, better than—heavier and more expensive equipment.

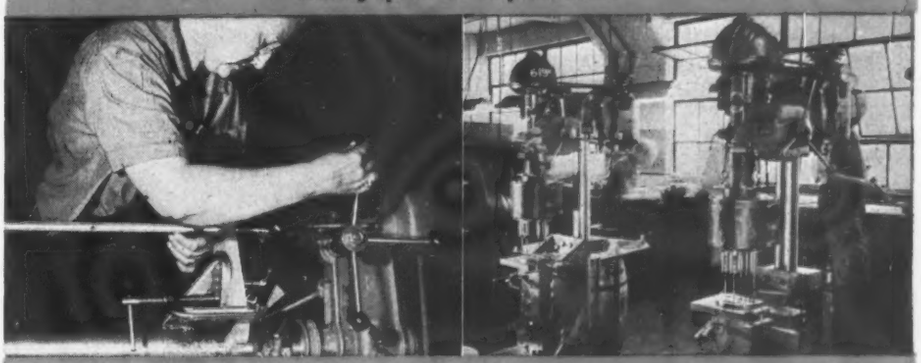
WALKER-TURNER COMPANY, Inc.
Plainfield **New Jersey**

HERE'S HOW WALKER-TURNER MACHINE-TOOLS CUT COSTS!



260-5200 R.P.M. 60-5300 S.F.M. 160-8300 R.P.M.

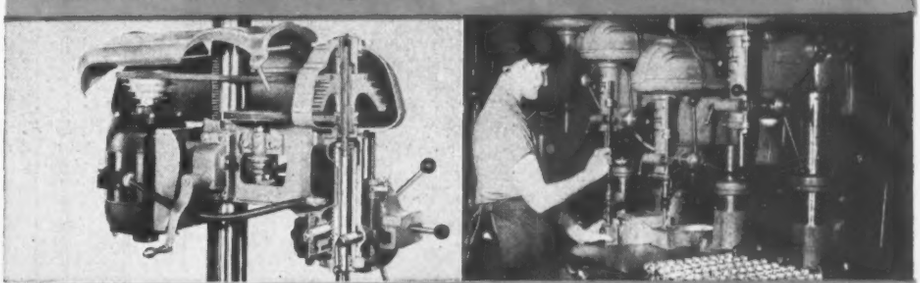
Wide range of operating speeds enables you to select the optimum cutting speed for any material.



Walker-Turner flexibility saves time and cuts costs in special tooling set-ups.

Set up horizontally, this Walker-Turner 15" Drill Press flares the ends of tubing.

This Walker-Turner 20" Drill Press drills five holes and reams two holes in one operation.



Low power consumption reduces operating costs.

This motor on a Walker-Turner 20" Drill Press provides speeds for drilling up to ¾" in steel, 1" in cast iron.

Low price decreases capital investment.

This Walker-Turner 4-spindle 20" Drill Press costs no more than a single heavy unit, yet has several times its production capacity.

walker-turner COMPANY, INC. PLAINFIELD, N.J. U.S.A.

MACHINE TOOLS

DRILL PRESSES — HAND AND POWER FEED • RADIAL DRILLS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
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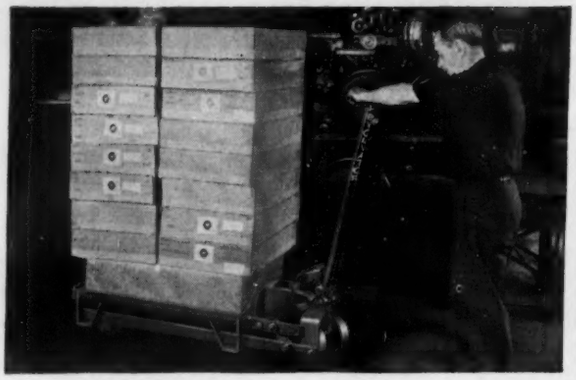
RED GIANT LIFTRUCK

For Skid Handling of Loads up to 5000 lbs.

A pleasure to operate —lifts load so easily in two simple strokes of handle which engages lifting mechanism automatically. Load rolls freely on ball or roller bearings and with little effort is brought to exact position desired by wide angle steering handle (75° arc) where load drops gently, cushioned by shock absorber.



RED GIANT LIFTRUCKS are extremely durable and economical. Can often be used in place of or to supplement expensive power trucks. Other models; Single Lift, Side Lift, Tin Plate, and Multiple Stroke Hydraulic. Send for Bulletin 140.

We also make the famous REVOLVATOR PORTABLE ELEVATOR, Hydraulic Ramp Eliminators, Carboy Dispensers, Barrel Lifts, Platform Skids and Storage Racks.

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quired amount of magnesium. By utilizing alternating current in the manufacture of ferrosilicon and by using the latter to reduce magnesium from burned magnesium limestone in a vacuum at high temperatures, the extra capacity was provided. Equipment for producing over 100,000,000 pounds of magnesium yearly by the process is now installed."

High-Purity Magnesium Alloys Seen as Important Development

Leo B. Grant, sales manager Magnesium Division, Dow Chemical Co., Midland, Mich.: "Although we hear a great deal about new and broadening uses for magnesium, over the past few years equally significant advances have been made in the technology of the metal, and the amount we know today represents a tremendous advance over what we knew just a short time ago.

"One of the most significant, recent developments is that of high-purity alloys possessing high corrosion-resisting properties. The composition of these new alloys revolves around the strict limitations of both iron and nickel to less than 0.005 per cent.

"There has been marked improvement and enlargement of both the permanent mold and die casting industry.

"Another recent development has been in the forging field. Before the war, the Germans were producing large press forgings, but today forgings of equal size and better quality are made here.

"With the development of new drawing and forming processes, magnesium is now coming to be thought of as a material which is as easily spun, drawn, or formed as aluminum, copper or steel. Deep-drawn parts are now being made in one operation.

"The electric welding of magnesium without the use of a welding flux has progressed from a laboratory curiosity to a full production process."

Latest Triumphs of Nickel and Alloys To Influence Planning

Eugene V. Ivanso, metallurgical engineer, Nickel Alloys Division, Steel Sales Corp., Detroit: "The war has served to accentuate the engineering utility of nickel and high nickel alloys. Under government allocation restrictions, these materials are still only available for certain critical uses, but the lessons learned during the war will find numerous peacetime applications.

"For instance, wrought Monel has been widely used during the war for

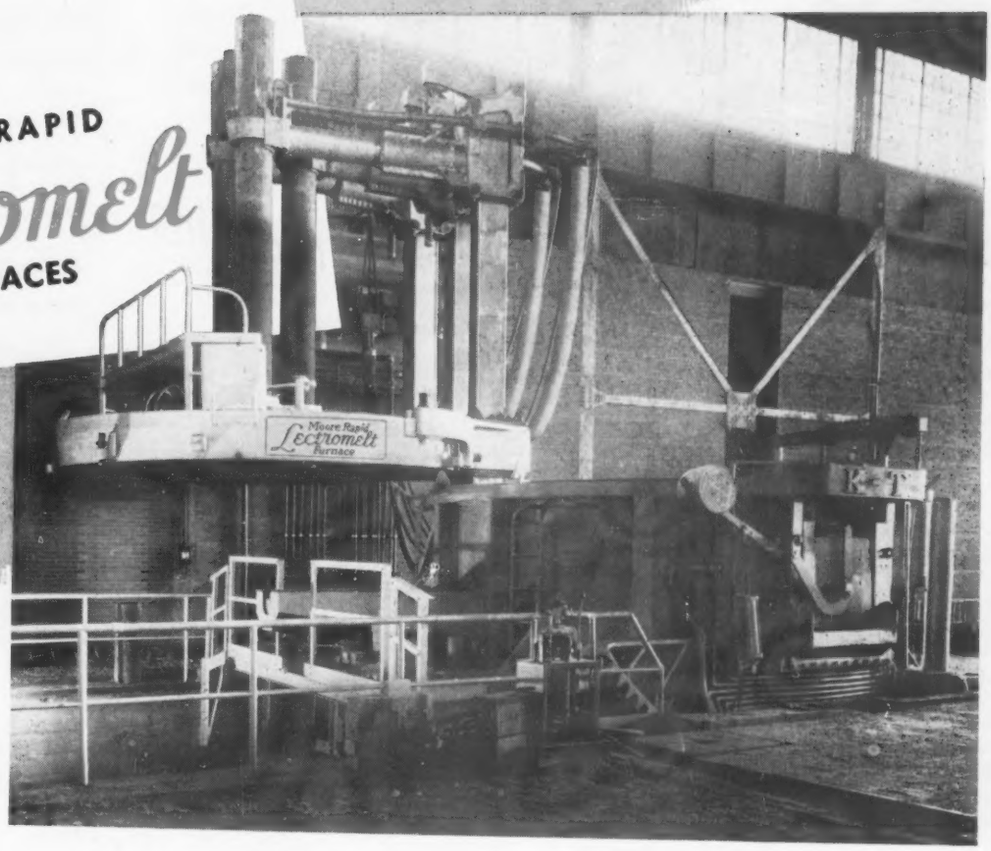
(*Please turn to Page* 402)

for SIMPLIFIED OPERATION

MOORE RAPID

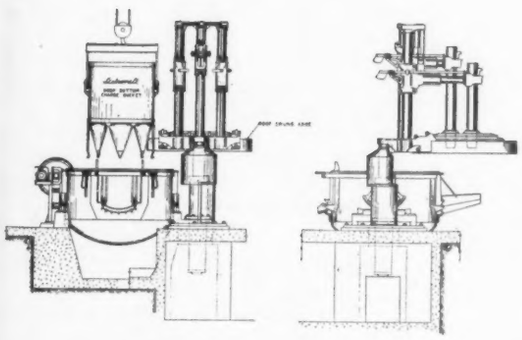
Lectromelt

FURNACES



A size "KT" Lectromelt, for pouring 40 to 50 ton heats, is shown with the roof rotated, ready to be charged by a drop bottom bucket.

The roof lifting apparatus as standard is stationary and separate from the furnace shell.



★ The advantage of top-charging and other exclusive design features of Lectromelt furnaces permit greater production in the melting of quality steels and irons.

Lectromelt top-charge furnaces are rugged in design and use a minimum of parts in the operation of the roof.

The furnace roof is hydraulically raised and swung aside by the operator moving one valve. On the larger capacity furnaces the tilting mechanism is hydraulically operated, while on the smaller sizes it is operated either by electric motor or by manual operation.

Top-charging by means of drop bottom bucket offers the following advantages to Lectromelt users:

GREATER PRODUCTION
INCREASED EFFICIENCY
REDUCED ELECTRODE CONSUMPTION
REDUCED REFRACTORY COSTS
MINIMUM MAINTENANCE

Lectromelt top-charge furnaces are available in sizes from 100 tons down to 250 pounds. Complete details on request.

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PITTSBURGH 30, PA.

TYPE CM20 $225.00
TYPE CM4 $425.00
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TOMBILL countersinking machine
has these advantages...

- OVER 100% INCREASED PRODUCTION
- 1/6 THE USUAL BENCH SPACE
- 1/5 THE USUAL POWER CONSUMPTION
- JUST 2 ROTATING MEMBERS
- MICROMETIC ADJUSTMENTS
- LOW INITIAL COST
- LOW OPERATING COST

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Powder Metallurgy

(*Concluded from Page* 278)

Research is increasing and the results point to better products and a wider field of use.

"Diffusion alloying of element metal powders into alloys during the sintering operation for better characteristics is being used extensively.

"It would seem that powder metallurgy fabrication of specialties which can be made in no other way, such as the porous bearings and hard cemented carbides have become more and more important in industry. Also the fabricated parts which compete on a price basis are becoming recognized and accepted."

Hot-Pressed Alloy Steels May Be Available in 1945

Gregory J. Comstock, professor of powder metallurgy, Stevens Institute of Technology, Hoboken, N. J.: "Powder metallurgy is now being given publicity as a part of the national advertising campaign of at least one large automotive company. The interest in the subject is increasing, as evidenced by the activities of various leading technical and engineering societies. The AIME, ASM, ASTM all have very active groups developing the technology and standardizing methods of testing metal powders and metal powder products.

"It is felt that a cheap method of producing alloy steel powders, and an efficient method for hot pressing them into the desired final forms are required for the producer use of metal powder technique. Both of these problems are the subject of intensive investigation. A cheap powder will do a great deal toward widening the industrial application of powder metallurgy. For this reason, efforts to lessen the cost of primary and alloy powders for metal powder molding are being made. It is hoped that hot pressed alloy steels will be available this year to industry. Progress has been made, particularly in nonferrous alloys."

Machining

(*Continued from Page* 284)

at arbitrary standardization would not be complete without consideration of the representative qualities of each.

"While considerable emphasis has been placed on results obtained with carbide tools, we should not lose sight of the important work done by the cast-cobalt chrome-tungsten alloy. Effectively bridging the gap between high-speed and carbide, these tools are cast to shape and ground to exact tolerances. These alloys have a hardness of 60 to 62 rockwell C, as cast, and a high red hardness evidenced by the drop of only one point rockwell C when cutting at

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- MERCHANT BARS—SHAPES
- HOT ROLLED STRIP—BANDS
- OPEN WEB STEEL JOISTS
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a temperature of 1900 degrees Fahr. The tools of this type operate most efficiently when cutting at speeds 25 to 80 per cent higher than the maximum speed of tools made from high speed steels. Cast-cobalt chrome-tungsten alloy also has proved to be an efficient cutting material when brazed on to a carbon steel shank."

Five Problems Block "Green Light" for High-Speed Milling

James R. Longwell, director of research and engineering, Carboloy Co. Inc., Detroit: "High-speed milling of steels with carbides — 500 feet per minute and up on steels of 170-200 brinell and 250 feet per minute and up on steels of around 450 brinell—is rapidly coming out of the experimental stage. During 1944 a vast amount of information has been collected on the subject and its technical feasibility is no longer in question.

"From a practical standpoint, however, much remains to be done. The important question in any new higher speed cutting process is this: Will it actually get more parts to the shipping platform per day and per week? It is possible to lose just as much time in tool maintenance as can be saved by faster cutting. High-speed milling of steel with carbides thus can easily prove an expense and a disappointment, if improperly applied.

"Among the problems which still have to be solved before high speed milling of steel can be said to have 'arrived' are:

1. Sharpening and maintenance of tools. Few plants have tool grinders sufficiently trained to be capable of properly sharpening the cutters involved.
2. Best methods of increasing the inertia mass—and how much it should be increased—in the cutter spindle. Flywheels are preferred at present.
3. Design of cutter with carbide inserts thick enough to permit changing the cutting angle to suit various hardnesses of steel. This design to allow for the use of simplified grinding techniques.
4. Methods for consistently obtaining proper relationship between work and cutter so as to insure that effective cutting angles actually correspond to the angles desired. A cutter with negative rakes may actually have a positive effective angle.
5. Design of machines and accessories to insure not only sufficient power but also to hold the work more securely."

Standardized Thread Milling Cutters To Alter Practice

S. B. Hellstrom, general manager, Detroit Tap & Tool Co., Detroit: "The recent development and wide-scale adoption of standardized thread milling cutters may be symptomatic of a major change in the generally accepted procedure for production of precision threads in either large or smaller quantities. Accelerated demand for accurately threaded parts, coupled with spectacular progress in manufacture of ground thread milling

(*Please turn to Page* 386)

Forging

(*Concluded from Page* 286)

own colossal needs, but also those of her vastly numerically superior Allies. To survive and later to prosper, we must make each manhour proportionately more productive—it is our economic life or death.

"Forging machinery designs in 1944 were pretty much frozen as they were in 1943. Practices, materials and detail designs, however, were better and often simpler, and when leavened by good management the results are certain to be 'as recorded.'

"The far-sighted policy of the WPB in surveying past and anticipated mortality in expendables has resulted in pool orders for these parts, and concurrently, a guarantee of minimum break-down time for the operators."

Field for Press Forgings Likely To Widen Soon

M. A. Monaghan Jr., vice president, Mondie Forge Co., Cleveland: "The forging industry, by the medium of educational advertising, is awakening the manufacturers of machines, tools, and equipment to the versatility and economy of the use of all types of forgings and the advantages forgings possess among various types of shaped material.

"Press forgings will come into great prominence in the immediate future.

"Better forgings will be made by the use of controlled temperature furnaces which will keep down scaling and thereby increase die life, allow lesser finish and draft for machining and improving grain flow and material structure."

Drawing and Forming

(*Concluded from Page* 287)

equipment. In second group are products which perform a useful function yet are completely dependent on appearance and style. Engineering is the next major consideration—price and marketing are important factors. This group includes business machines, lighting, gasoline station equipment, household appliances, and many other items.

"The third group is sold entirely by style, color and appearance. Selection of material not only will influence production and price, but will make the article desirable."

Joining and Welding

(*Continued from Page* 290)

tainment of these controls in our plants was a long and tedious task, requiring more than 8 years.

"It is not necessary to change basic methods of compensation to facilitate use of a production welding control system. Whether the piece rate, day rate or base-rate-plus-premium method of compensation is used, the values can be greatly enhanced. However, practical experience has indicated that most advantage is to be gained from the base-rate-plus premium method.

"The production welding control system is based upon the actual recording of arc time. The single unit arc timer provides visual arc time reading only. The centralized recording system provides both visual and permanent graphic records which shows the arc time in relation to the idle time. So complete and simple is this record that it is possible to read from it anything anyone desires to know on any type of welding job with regard to the costs, procedure, etc."

Aluminum Bronze Welding Electrodes Highly Developed

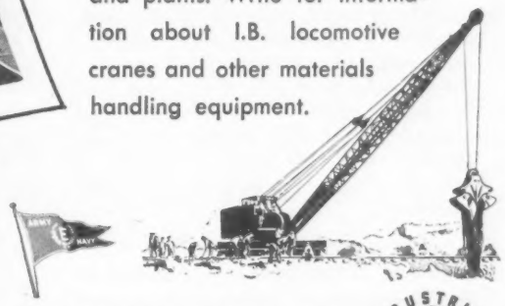
J. D. Zaiser, executive vice president, Ampco Metal Inc., Milwaukee: "In the bronze alloy industry, 1944 was primarily a year of leveled production experience, whereby new processes or improvements of old processes moved from the 'tryout' phase into regular production. It saw the use of such alloys as the copper-nickel-beryllium series expanded to applications such as clutch drums, and also development of centrifugal castings in the field of special shapes and contours.

"One outstanding development was the perfection for industrial use of coated aluminum bronze welding electrodes. Thus, high strength, corrosion and fatigue resistance, good bearing properties, and wear resistance of aluminum bronze for the first time were made available to industry for welding. Overlay, fabrication, and repair work now can be done better with bronze than ever before, and war materiel is begin-

(*Please turn to Page* 386)

Industrial Brownhoist Equipment SOLVES many a material handling problem

A large midwest steel company had a material handling problem of unloading and loading a big tonnage of iron ore from boat to storage to transfer car. An I.B. 15 ton Traveling Bridge Crane (left) easily solved the problem by handling from 800 to 1000 tons per hour. I.B. cranes are speeding the handling of ore, coal, aggregates, scrap iron and other materials in America's busiest ports and plants. Write for information about I.B. locomotive cranes and other materials handling equipment.



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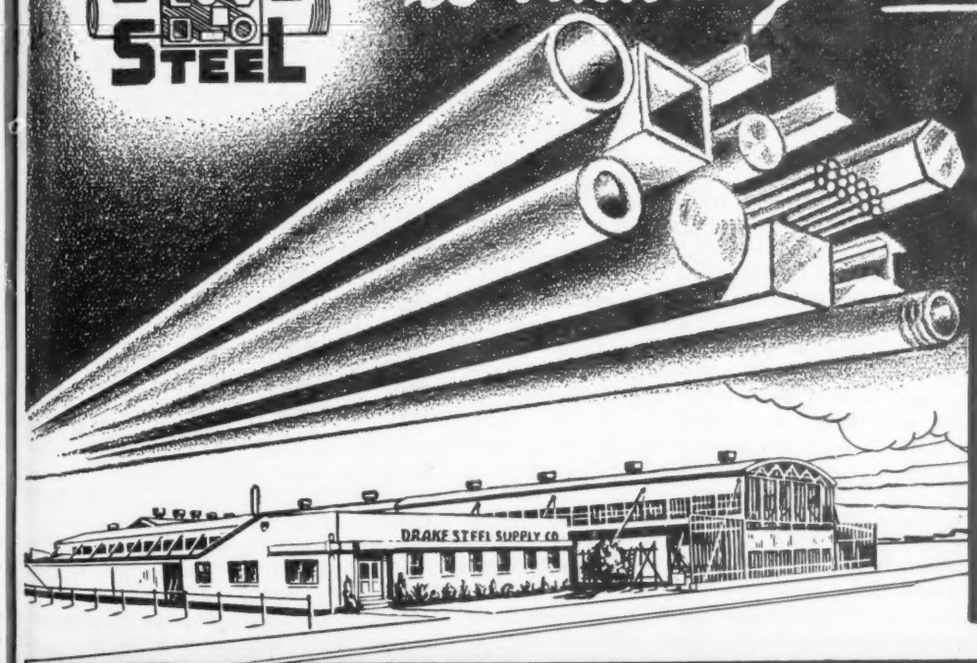
is building to serve you better



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Extra heavy
Double extra heavy

STEEL

Hot Rolled:
Bands—Bars
and Structurals
Cold Rolled:
Rounds—Squares
Hexagons—Flats

TUBING

Electric Welded and Seamless:
Rounds—Squares
and Shapes

DRAKE STEEL SUPPLY CO.

10660 SOUTH ALAMEDA STREET • LOS ANGELES 2, CALIF.

LUCAS 6241

(*Concluded from Page* 384)

cutters capable of producing threads held to unusually close tolerances, previously obtainable only by thread grinding, resulted in a vast number of overlapping designs for similar jobs.

"Need of some kind of a program of standardization finally became urgent.

"While standardization of cutters for universal applications was impractical at the outset, at least it was found that a majority of the most frequently used cutters could be ground from a group of about 60 basic blank designs and that many more operations could be performed by the use of cutters finished from these blank designs, in place of 'specials'.

"Thus, while universal utilization of thread milling cutters originally came about as a valuable wartime expedient to speed up production of accurate threads, the fact that they now have reached a stage where practical standardization is possible is indicative of a trend toward still further extension of precision thread milling in peacetime production."

Greater Horsepower Obtainable In "Packaged" Electric Drives

Richard A. Geuder, manager, Applied Engineering, Reliance Electric & Engineering Co., Cleveland: "The successful development in packaged sizes from 30 to 200 horsepower of integrated adjustable speed drives to obtain very wide ranges in speed has been one of the interesting accomplishments of the past year.

"In this much larger version of one-type known as the 'V-S' drive originally introduced 6 years ago in 1 to 15 horsepower sizes, subsequently increased from 15 to 30 horsepower, and now to 200 horsepower, all of the desired functions are still made available in a packaged article.

"The packaging of electrical equipment has been immensely accelerated by the war for a number of reasons. First, the trend to greater protection for electrical equipment has assumed even greater importance as more and more motors have been built for war jobs so vital that interruption of operations must be held to the absolute minimum. Second, machinery of all kinds has received much more abuse as the proportion of green workers has risen. Third, space available for electrical and other machinery has been greatly restricted in many instances, either by the increase in number of units to be crowded into a given plant area or by the nature of the technological advances in the art itself. Finally, more and more emphasis is being put on safety from the operator's point of view. The packaged adjustable speed drive provides such safeguards more completely and effectively than is possible with any other practical method.

"It has been found that in such packaged drives, conversion is obtained for approximately $50 a kilowatt, whereas cost of direct current throughout a plant may vary anywhere from $75 to $110 per kilowatt. Moreover, the ability to secure the adjustable speed feature where and when wanted without being dependent on a central distribution system possesses advantages far beyond first cost."

Broaching Economical for Certain Job Lot Applications

Harry Gotberg, chief engineer, Colonial Broach Co., Detroit: "Since modern broaching was developed largely in the automotive industry, there is a disposition in some quarters of the metalworking industry to regard the process as primarily fitted only for mass production. While this may have been true in the early years of broaching, it certainly does not hold true today, and indications are that it will become even less so in the days to come.

"At the present time, broaching—when properly engineered for the work in hand—can be and is being economically used in job lot production in many smaller shops. In fact, broaching is actually competing today with the general run of milling, boring and reaming operations, particularly where extremely close tolerances and fine finishes are desired.

"Several factors have combined to bring this about. Broaching machines have been greatly improved, especially as regards their flexibility. Thus, some types of broaching presses may be used for assembly work, for push broaching or pull broaching, and may be converted from bench to pedestal type and vice versa. In this way, a far greater return is now being realized from broaching machines than heretofore.

"While broaching was considered largely as a process for machining internal surfaces, its later adaptation to external work bids fair to eclipse so-called 'hole' broaching."

(*Continued from Page* 384)

ning to embody the use of aluminum bronze welding in its construction."

Subject Metals to Triaxial Stresses for Improved Design

A. P. Young, associate professor, Mechanical Engineering, Michigan College of Mining and Technology: "Among all the fields of engineering accelerated by the war, I think the field of air conditioning and heating holds one of the most promising outlets for our young engineers. With the release of building materials from priority the building program will open up, and heating, ventilating, and air conditioning will expand along with it. One possibility is that a large number of men and concerns without sufficient technical background and experience to make them capable of properly designing modern systems will mushroom into this field.

"We all know the vital part welding has played in the war effort, both in production of ordnance and naval material and in the maintenance and salvage of damaged equipment and vessels. The investigations into the problem of failures in welded ships seem to indicate that the welds and plates failed because of triaxial load conditions which produced stress so aligned that elastic behavior was impossible. At the present time I am working on the development of a test specimen by which a piece of material may be subjected to three loads mutually at right angles so that the behavior of the material may be studied and limiting stresses determined. When the behavior pattern of materials under triaxial stresses has been established, the problems will be more easily solved.

"Welding is now one of the major fabricating tools of production, and it can become the most efficient tool which engineering will have in the future. There are many 'bugs' to be eliminated from the art of welding, but research can and will overcome them."

Trained Welding Engineer To Be in Great Demand

J. R. Stitt, associate professor, Welding Engineering, Ohio State University: "The welding engineer must have a broad type of training as he will work with welding problems more as a consultant within the company, mill or yard. He will be asked to assist with welded designs whether they be structural, or mechanical; to determine stress relieving cycles for castings and forgings where no welding is involved; to outline procedures for repairs which are most urgently needed to keep production moving; to interpret X-ray and other inspection results, to say nothing of acting as a trouble shooter on automatic welding equipment, which is not always automatic.

"After the war trained welding engineers will be in demand as never before. Yes, more than even today. I base this prediction on the fact that today

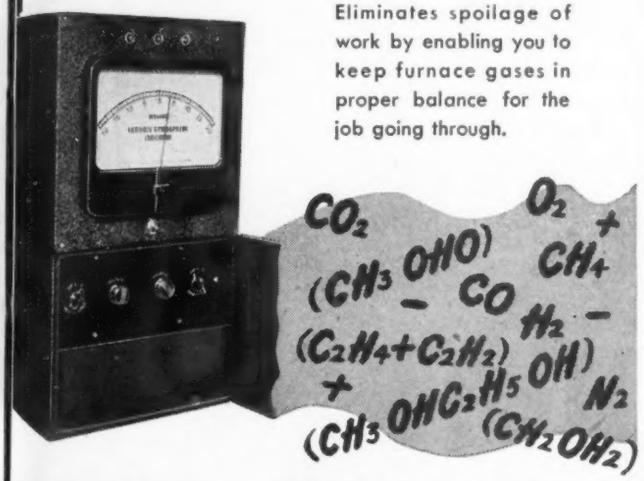
Is Oxidation Robbing You Blind?

It didn't rob one Connecticut user *after* they installed a Weaver Furnace Atmosphere Indicator. Here is an excerpt from a report on what it did for them.

"... the instrument saved them many hundreds of dollars when the gas failed ... and they were able to note immediately that something was wrong with the atmosphere. If they hadn't found it out when they did, the whole load of work going through the furnace that night would have spoiled. They had been getting a lot of air coming through which badly oxidized the work. The indication of the Weaver enabled them to correct the atmosphere in time and avoid losses."

Here, *on only one job,* the Weaver saved more than its own cost.

THE WEAVER FURNACE ATMOSPHERE INDICATOR



Eliminates spoilage of work by enabling you to keep furnace gases in proper balance for the job going through.

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It operates on the thermal conductivity principle of gas analysis—registers instantly on the dial any change in furnace atmosphere—permits immediate adjustments.

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4. Unqualifiedly guaranteed.

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"As the sections are thinned down, greater unit stresses will result. These greater unit stresses will often have to be transmitted across joints. Joints necessarily will have to be better. Even the welded joints we are producing today will have to be improved.

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Diverse Joining Techniques Show Numerous "Family" Traits

Robert E. Kinkead, consulting engineer, Cleveland: "Probably few technical fields have expanded as a consequence of war use more rapidly and to the same degree as welding processes. It would be safe to say that there are 25 people in 1945 who have more than superficial technical knowledge of welding to one of equal knowledge in 1940. Not only has the personnel expanded but new processes in resistance, gas, arc welding have been invented. The science of welding and that of soldering, brazing, resin bonding are beginning to show signs of merging into a broad engineering classification which may some day take a name that will include them all.

"We may expect progress in the following fields of joining materials. Metals to nonmetallic substances by molecular bond; composite metals of the clad type and also bonding of different metals in one part of a structure to meet variable needs for physical properties. All welding processes will experience development of automatic high speed operation. Look for results soon in the use of catalytic agents in the welding and bonding of materials. It will explode many fixed beliefs."

Flexible New Fasteners To Streamline Postwar Assembly

George A. Tinnerman, vice president and general manager, Tinnerman Products Inc., Cleveland: "The present war, with its incessant demands for more and more materials, has provided considerable impetus to the further development of Speed Nut spring tension fasteners. New and improved types have been designed for use on aircraft, trucks, tanks, jeeps, communication equipment and other war products . . . speeding up their assembly and substantially reducing weight and costs.

"Since their fastening prongs can be incorporated in most any shape or form, these fasteners may be designed to meet specific assembly requirements. This flexibility of design, which has been invaluable in solving difficult fastening problems on war products, should prove equally helpful when peacetime production is resumed. In addition, we've learned how to make better fasteners than ever before . . . through improved design, better production methods, rigid quality control and uniformly accurate heat treating."

More Intricate Assemblies To Follow Fastener Progress

Ernest Schleusener, vice president, Oliver Iron & Steel Corp., Pittburgh, Pa.: "The industrial fasteners industry has been called upon for growing quantities of small precision formed and machined high-strength parts.

"To do this, the industry, which already had experienced a general but rather steady lowering of tolerances allowed on its products, suddenly had to increase fabrication of such parts at an accelerated rate—a rate even more rapid than the introduction of new and improved equipment. Hence, machines formerly used to perform relatively simple operations were remodeled to turn out close tolerances heretofore unheard of in the industry. With these new developments, and with the gradual addition of new equipment, the industry is better equipped to produce quality products than at any time in its history.

"Designers of postwar equipment, having recognized the definite advantages of this type fastener, will want to include more small high-strength precision parts in future designs knowing that they have longer lasting qualities and offer more rigid and lighter assemblies. Based on experience, there is reason to believe that the current trend toward more and more small precision parts of high strength will continue."

Combination of Electronic Welding Controls Progresses

C. J. Collom, president, Weltronic Co., Detroit: "Originally the prime objective in the use of electronic control of resistance welding was to eliminate human error only in the timing of welding current flow, then the most apparent handicap to the consistent production of good welds.

"There has been a simplification of circuits in the electronic controls, and designing of interchangeable units permitting their integration, while providing easier maintenance. Demand has grown for units forming a combination of a universal timer, heat control and contactor that either can be mounted on the welder or housed within the machine.

"Electronic controls during 1944 have developed hand-in-hand with resistance welding progress. Among the widely accepted applications are: Control of electrode movement and pressure, split-cycle timing, dial control of welding heat, silent arcless interruption of enormous currents, elimination of transient currents, synchronization of welder operation with power supply cycles, pulsation of welding current, and the sequencing of operations in the welding cycle."

Techniques for Resistance Welding Vastly Improved

Fred H. Johnson, president, Progressive Welder Co., Detroit: "During the past year or so, techniques and equipment for resistance welding have shown probably the greatest improvement in their history. The war brought with it the need for much faster and simplified assembly methods in metalworking. Resistance welding provided an obvious answer. At the same time, changes in materials introduced new problems. Alloy steels, particularly the hardenable varieties had to be handled in large quantities.

"Resistance welding as a whole has tended to become more and more complicated, as closer controls were demanded for greater consistency of welds. It is possible that the recent introduction of welders powered by storage batteries may prove to be the eventual answer.

"Many new developments along the line of post heat-treating welds have appeared already, and undoubtedly more will make their appearance in the year to come. Such developments are to influence the design and construction of housing, railroads, motor vehicles, etc., and welding heavier gages of metal."

Casting

(*Continued from Page* 272)

ciety for Testing Material with their revised B-85-44 T specifications. There are two alloys—S-5, a 12 per cent silicon alloy and SC-7, a 3.5 per cent copper, 8.5 per cent silicon alloy—that are considered main alloys. However, there are two other alloys—S-4, a 5 per cent silicon alloy, and SC-2, a 3.5 per cent copper, 5 per cent silicon alloy—that will be used to obtain certain physical and machining characteristics.

"Third improvement has been in quality control of alloys and foundry practice. The spectrograph has made an easy and quick method of analyzing alloys. Foundry practice is checked by the use of radiography and fluoroscopy.

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Either one, or both, are very essential in controlling the variables.

"Due to the fact the die casting industry is contemplating extension of its large research and development programs, we can expect just as great advancement in the future as there has been in the past."

Survival of Small Foundry Depends on Mechanization

Harold J. Roast, vice president, Canadian Bronze Co. Ltd., Montreal, Canada: "As one looks over the nonferrous foundry aspects of the metallurgical field of 1944 and considers the probable requirements of 1945, it appears that the outstanding factor will be the increase in mechanical processes for the foundry.

"For years, we have had efficient production molding machines for green sand but these have been used chiefly by large foundry organizations. It will become imperative for the small foundries that hope to survive to install such mechanical equipment. The more recent, but still frequent, use of permanent mold in place of sand molds will also have to be adopted. Where applicable, it will be found important to adopt centrifugal permanent mold casting. To a lesser extent centrifugal dry sand casting will have its place.

"A word of warning might well be issued here to the effect that centrifugal casting is not a foolproof method. In the first place, the forces involved are frequently very great and machines should only be designed by qualified engineers. The ease with which holes can develop in castings made in centrifugal permanent molds calls for concentrated attention on the protective coatings used for the mold.

"It is my belief that it will be found desirable to melt in high frequency induction type units for permanent mold centrifugal work. The greater control of temperature and the attractive working conditions due to the removal of hot furnaces in or near the casting room will attract a better quality of labor and keep the same contented."

Product Uniformity Essential For Peacetime Competition

N. K. B. Patch, secretary, Lumen Bearing Co., Buffalo, N. Y.: "Everyone in the industry has recognized that with the change from war conditions to peace conditions competition will develop many problems. Those who are prepared to meet competition with some new type of product or some product that has been vastly improved, are going to have the advantage; consequently, many have made efforts to uncover methods of control of products that will insure a higher degree of uniformity, a more accurate control of production and increased knowledge of how to apply their products in every case with the maximum effectiveness.

"I see ahead for quite a number of years to come a demand upon the manufacturing facilities of this country that will exceed the war demands even though it is for civilian goods. During that time industry can set itself in order so that it can meet the growth of competition that must inevitably follow when other nations are once more on a sound footing and organized for production of their own requirements. This country, during those years should, however, find a vast number of new markets so that loss of some markets will not make serious inroads into the volume of exports from this country."

Water Quenching Extended to Many Types of Castings in '44

Charles W. Briggs, technical and research director, Steel Founders' Society of America, Cleveland, O.: "Progress and significant developments can be reported for 1944 in the field of steel castings. Water quenching was extended to many casting types during the year. Information on the technique of water quenching, using time-quench methods, and production equipment as employed at various foundries, has been extensively reported. Considerable information on the compositions and casting sections to quench-out the varying sections in commercial castings is being developed.

"Full discussion of electric furnace steelmaking problems, made possible through the Electric Furnace Steel Conferences, has assisted materially in production problems. The steel casting industry is giving the conference its wholehearted support.

"Research investigation by the Society on carbon and certain alloy cast steels, has shown that time-temperature transformation curves for cast steel are similar in shape and position to those for wrought steel of similar compositions. This means that all the S-curves developed for wrought steels can be utilized in the heat treatment of steel castings.

"It has been possible during the year to present details on the production of certain ordnance castings, such as the very important and highly stressed breech ring castings for guns.

"The industry has continued with the production of certain of the NE steels, and is investigating others. Results on the properties of commercially produced NE cast steel were reported during the year."

War Accelerates Adoption of Better Steel Casting Methods

Frederick A. Melmoth, vice president, Detroit Steel Casting Co., Detroit: "In times of war it is normal for development pressures to concentrate themselves upon increased quantity production, and the means of achieving it. However, it has proven equally true in the steel castings industry that achievement of special applications has resulted.

A combination of suitable chemical compositions and a wider scope of heat treatment has produced with regularity, castings for specific war duties, and at the same time widened the possibilities of postwar use. The exigencies of war production have spread more evenly over the members of the industry the improved technique and fundamental knowledge becoming available at an accelerated pace. One must identify this period with an increased realization by the industry of the great value of organized research. Schemes have been inaugurated which promise well for the future, and which should remove any suggestion of backwardness.

"Nondestructive testing and inspection methods, X-ray, gamma ray and magnetic particle alike, have been widely adopted. The steel foundry will use these methods to the full to improve service performance."

Control Tools for Liquid Quenching Are Invaluable

R. C. Heaslett, general metallurgist, Continental Foundry & Machine Co., Coraopolis, Pa.: "Improving the quality of commercial steel castings varying in weight from 1 to 85,000 pounds by liquid quenching is one of the outstanding contributions made to the steel industry in the recent past. As late as 1940 the tonnage of liquid quenched castings compared to those normalized or full annealed was very low. Today, there are thousands of tons being supplied to the trade with excellent physical properties which adapt them for the most severe service in extremely diversified fields.

"Although the improved physical properties developed by liquid quenching steel castings were well known, it is fact that liquid quenching was forbidden by many specifications for years.

"Fortunately for the steel casting industry the war changed the entire picture, since the urgent demand for heat treated alloy steel castings, particularly for tank parts, permitted no alternative. To obtain the physical properties required to withstand ballistics, liquid

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quenching was necessary. This was the signal for installation of all types of modern heat treating equipment and control instruments in steel foundries, including the latest in bell type, car type and continuous heat treating furnaces, quenching tanks with controlled cooling systems, circulating and propeller type agitation, and spraying installations for special jobs.

"The temperature controls were the last word in instrumentation.

"There has been a definite improvement in the technique of handling liquid quenched castings, armor or otherwise, since the war program started. Obtaining the highest physical properties with practically no distortion or quenching checks has been the reward for intensive study in the art of quenching castings of great variation in size, section, design and analysis.

"This improved technique has been largely due to the intelligent application of time, temperature, transformation curves in conjunction with exhaustive studies in the research laboratories. Martempering and austempering or modifications of them are also being utilized to a limited extent on both large and small castings.

"The ability of steel castings to develop greatly improved physical characteristics by liquid quenching has been materially aided by producing castings of greater density with freedom from shrinkage and other defects. This is a direct result of better molding and casting technique made possible by the extensive use of radiography, which is now being employed by all up and going foundries."

Wartime Puts "Lost Wax" Technique in Forefront

John Howe Hall, metallurgist, General Steel Castings Corp., Eddystone, Pa.: "The most spectacular development of recent years is in the field of precision casting of small parts. Utilizing the centuries-old 'lost wax' method, and either centrifugal force or pressure to force the metal into the molds, castings of special steels and other metals are being produced to a degree of accuracy formerly undreamed of. Only the dental technician, producing inlays and inserted fillings which must be accurate to an extraordinary degree, has practiced this art, until quite recent years.

"Wartime developments continue to lead to great increases in our knowledge of heat treatment processes for cast steel. In particular, liquid quenching and tempering is rapidly gaining adherents as the one best method of securing the highest possible properties from steel castings. A development that began in a small way in 1909 has thus, after over 30 years, secured wide acceptance.

"During the past year the art of centrifugal casting has been given a great deal of critical discussion which has led to a more rational understanding of its advantages and disadvantages."

Shift from Forgings to Die Castings for Certain Parts Seen

Herbert Chase, consultant, Forest Hills, N. Y.: "Outstanding among the developments in die casting during 1944 has been the attainment of quality in a degree hardly thought to be commercially attainable until recently. This is quite largely a result of war demands in which the matter of costs is secondary to the attainment of quality upon which all-important performance may depend.

"Much has been achieved, as far as aircraft applications are concerned, through the use of X-ray equipment in producing aluminum and, to some extent, magnesium die castings in which freedom from porosity—of such extent as to impair soundness—is essential. It has proved practical to produce castings, some having extraordinary complexity and quite large size for uses that would not have been considered even a year or two ago. Some such castings may yet take the place of forgings, say in parts that rotate at extremely high speed, and save a prodigious amount of machine work.

"But soundness is only one direction in which quality has been improved and it is not confined, by any means, to light alloys. The zinc alloys, for example, have been applied extensively—as in some ordnance applications—where a dense and homogeneous structure is essential and precision, with a minimum of machine work, has been essential partly because of labor shortages. The zinc die casting, especially, has taken the place of specific screw machine products and has yielded highly satisfactory parts at lower cost and with far higher economy in metal and in labor utilization.

"In still other fields, as for example, in machine parts for highly important communication applications, the zinc die casting has been made into parts of extreme precision yet requiring almost no machine work. This has helped to some extent to relieve the critical shortage of castings from sand foundries and at the same time has made available for other use machine facilities and skilled machinists."

Die-Cast Aluminum Bids for Larger Share in Automobiles

J. C. Fox, chief metallurgist, Doehler Die Casting Co., Toledo, O.: "The very extensive and diversified applications of die castings of all metals in the present war program will unquestionably have the effect of stimulating and promoting the postwar outlook for this method of metal fabrication. Research and development of better casting alloys, die steels, and casting machines as well as better methods and materials for finishing, which has been progressing through the past few years, will greatly aid this advancement.

"In present war uses, aluminum and magnesium die casting applications have greatly increased in volume over prewar use, while zinc and brass die castings, because of the curtailment of civilian commodities, have been less than the prewar consumption. It is expected that zinc die castings will regain some if not all of its former prominence, especially as automotive hardware, grilles, carburetors and similar uses where zinc alloy die castings have so long been successfully applied.

"We are very enthusiastic regarding the role that copper base (brass) die castings are to play in the near future. The extremely high physical properties and corrosion resistance of these alloys will force their greater use, possibly displacing other metals and methods.

"Aluminum die castings will find greater postwar use than previously. This belief is based not only on the competitive position which aluminum will attain due to the availability of large stocks of aluminum war scrap, but also on the technical advances, made during the war. The use of aluminum die castings may extend to parts formerly produced in other metals, such as automotive transmission housings, generator frames, motor end bells, fluid drive equipment and other similar parts.

"It is believed that magnesium die castings will increase over the prewar quantity, particularly through advances which will be made as a result of the extensive researches now being conducted on alloy compositions, alloying and melting practice and casting technique."

Heat Treating

(*Continued from Page* 292)

of obtaining improved hardness and lessening the use of alloys by studying the influence of carbon, particularly the hyper carbon, upon hardenability, can be of material assistance in enabling the steel user to make a more economical selection of steel of the carburizing grades."

Nitriding of Cutting Tools Top Favorite of Surface Finishes

George A. Roberts, research metallurgist, Vanadium-Alloys Steel Co., Latrobe, Pa.: "During the past year, practically no treatment for the surface finishing of tools which is entirely new has been proposed. Major developments have occurred by means of a wider understanding of the limitations as well as advantages of each of several treatments which have in the past been suggested and applied. It is expected that many or all of these treatments will play an increasing role in the future in the effective utilization of our tool materials. They include nitriding, carburizing, chromium plating, oxidation and superfinishing.

"Of all of these treatments, perhaps nitriding is the most widely used for

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high-speed steel cutting tools. In the majority of cases, this is performed in a salt bath consisting of molten cyanides held at a temperature of between 1000 and 1050 degrees Fahr. The nitriding treatment is applied to finished, ground, hardened and tempered tools, since high-speed steel can be heated to this temperature without loss of hardness. The nitrided case, extending from 0.0005 to 0.002-inch in depth, is extremely hard, has low coefficient of friction and excellent wear resistance. It is especially applicable in cases where misalignment problems are at a minimum and finds considerable use in the tap and chaser field.

"Carburizing of high speed steel is somewhat similar to nitriding in that carbon, like nitrogen in nitriding, is caused to diffuse into the surface layers. It does not follow, however, that carburizing can be used for the same purposes as nitriding, since the usual carburizing treatments for high speed steel, in order to increase the wear resistance to a satisfactory high level, must introduce a considerable amount of carbon which embrittles any fine cutting edge. The carburizing of high speed steel is especially applicable for many classes of blanking dies and other tools, where wear resistance is of prime importance.

"Chromium plating has received added impetus and will continue to grow.

"Improved surface finishes achieved by superfinishing or by the recently announced method of 'liquid honing' operate successfully on many types of cutting tools."

Predicts Molten Salt Baths Will Win Wider Acceptance

Paul H. Kramer, technical director, Park Chemical Co., Detroit: "The huge production of war materials throughout 1944 was accompanied by a marked increase in heat treatment of steel and nonferrous metals. Continued shortages of critical materials and skilled labor influenced a search for simpler and faster methods of heat treating.

"Probably the most significant factor in speeding up and simplifying heat treating processes has been the increased use of molten salt baths. Nearly all of these processes are now being accomplished in salt baths. The introduction of the electrode-type electric furnace has even removed the limits on the size of pot which may be operated.

"Steel may be bright-tempered or blackened in salt baths. It can be hardened without trace of carburization or decarburization. Most of these processes may be performed in such simple equipment, and so easily and rapidly that workers may be taught their duties in a remarkably short time.

"For the future we look forward to further increases in the use of salt baths, particularly in the field of isothermal transformation processing, and for carburizing. The uniform case depths, improved surface condition, speed of penetration, and ease of direct quench are advantages of liquid carburizers which are just recently being realized. The introduction of a stop-off paint which gives positive protection in selective carburizing has given added incentive to the heat treater to adopt the liquid carburizing baths."

"Skin" Recovery Process Gives Added Protection Against Defects

R. J. Cowan, consulting engineer, Youngstown, O.: "A notable advance in heat treating has taken place in the field of gas carburizing. This is known as the 'skin recovery' process and consists of adding carbon to the surface of steel which has been decarburized by some manufacturing stage, usually preceding the final one.

"In the 'skin recovery' process, the atmosphere surrounding the steel is in balance with the carbon content of the interior of the steel, so that when the steel is held at temperature the carbon diffuses both inwardly and outwardly until a balance is obtained which will not be changed by prolonged holding at the temperature used. Because of this, the part may be held at temperature for a time long enough to recover the areas which have been deeply decarburized without injuring those that are only slightly decarburized.

"This process has been made possible by the refinements of control used in commercial gas carburizing."

Instrument Broadens Range of Magnetic Particle Inspection

M. V. Healey, Works Laboratory, General Electric Co., Schenectady, N. Y.: "Magnetic particle inspection, when properly applied, provides a means whereby assurance can be had of freedom from certain harmful defects in ferromagnetic cast materials. The defects best revealed are cracks extending to or close to the surface.

"Magnetization for testing is usually accomplished by passing a current through the casting as a whole (overall method) or through a section of it (prod method). The magnetic field thus produced varies widely, depending on several factors. Only in castings of uniform cross section throughout can the strength of the field be calculated, even to a fair degree.

"While it has been known for some time that a casting must be magnetized to the proper degree for effective testing, lack of a method of measuring the magnetization prevented correlation of data and development of adequate methods of test. Within the past year an instrument has been developed for indicating the degree of magnetization at any point on the surface of a casting under test. It is now possible to determine the optimum field strength for testing and feasible to specify the limits at which tests are to be conducted.

"The recently adopted ASTM Tentative Method for Magnetic Particle Testing of Steel Castings, No. A-272-44T, suggests that the optimum field strength is probably between the region of maximum permeability and a point well below the magnetic saturation of the steel. Closer definition, while possible, requires experimental evidence.

"It is obvious that measurement of field strength is a basic necessity in magnetic particle testing. Now that we have a means of doing this, progress in its development should be rapid."

Results of Heat-Treating Alloys Emphasize Need for Uniformity

L. L. Farrall, metallurgical engineer, Rotary Electric Steel Co., Detroit: "Increased tempo of the hardenability program probably represents one of the most important developments in the metallurgy of steel during the past year. In the manufacture of ordnance materials, many improvements in processing and heat treating have served to emphasize the extreme need of uniformity in steel. This is especially true of the alloy steels in which the potential properties are developed by heat treatment. It is not possible to predict the performance of a heat of steel by merely recognizing that it is within the limits of the customary chemical specification; consequently, hardenability has been recognized as one of the more important factors.

"Organized effort to determine the workable limits of the hardenability of various types of alloy steel has culminated in the publication by the American Iron and Steel Institute and the Society of Automotive Engineers of a series of tentative end-quench hardenability bands for some of the more commonly used alloy steels. Actual experience in making steel to the hardenability control suggested by the bands is somewhat limited. However, it is felt that this control can be accomplished without materially changing the basic steel composition, if the present close chemical ranges can be widened somewhat. This would permit the mills to properly adjust the amounts of the different hardening elements so as to meet the hardenability requirements.

"Hardenability control specified in terms of bands, minimums or maximums should enable the user to obtain a more uniform product from heat to heat from one or more steel plants. The occasional heat which is within present chemical limits, but which reacts unfavorably in fabrication should be eliminated. Proper use of hardenability control should re-

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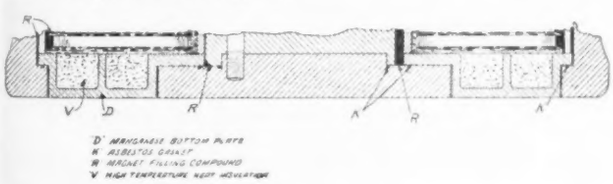

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move some of the problems caused by abnormal conditions of residual elements. These unwanted elements would be taken into account in evaluating the hardenability of a heat and thus, an overall conservation would be effected.

"In all probability as more experience is gained in the control of hardenability in the mills and the use of these steels in the consumers plant increases, the metallurgical problems will be simplified and better products will result."

Use of Protective Atmospheres Grows Following Refinements

Willard Roth, Transportation & Generator Division Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.: "The war period has seen accelerated development in heat treating methods and equipment. Some of these are significant in their relation to postwar industry and methods, a chief one being rapid growth in use of protective atmospheres and the accompanying evolution in furnace designs to properly utilize them. Another related development has been a rapid improvement in quenching, with a strong trend toward use of automatic quenching directly from the furnace without manual handling.

"The last year or so has seen a progressive and rapid refinement in atmosphere generating equipment and in measurement devices. Much of it has been in the direction of controlling the carbon potential in the atmosphere to equilibrium or approximate equilibrium with carbon in the steel. Purpose of this is to heat treat various carbon steels without either carburization or decarburization. Molybdenum high-speed steels, for instance, can be dependably hardened without decarburization and, of course, without scaling. Likewise, medium or high carbon assemblies may be copper brazed without decarburization. Virtually all of the medium and high carbon alloy steels can be annealed, normalized, hardened, and drawn without carburization or decarburization. Not all of these operations are carried out in the same atmosphere, however.

"Now in that consistent heat-treating results are made possible, dependable metallurgical properties in the war materials we are now making are insured. The effect is also to reduce machining hitherto necessary to remove decarburized skin.

"In the field of powdered metals, low cost atmospheres have been developed to provide the high reducing properties necessary for reduction of oxides and for sintering.

"In the nitriding field, costs have been reduced partly through the reduction in the cost of ammonia itself, and partly because higher dissociation rates have been found permissible. Nitriding furnace designs also have been refined to permit a further saving in ammonia consumption. This reduced cost of nitriding, coupled with the superior properties obtained, may result in its wider use in the automotive industries after the war.

"In gas carburizing, considerable progress has been made in controlling carbon concentration in the outer case layers. This is of considerable metallurgical importance, and further refinement along this line may be expected.

"Among developments in measuring instruments, the carbon potential gage is proving to be a valuable aid in process control. It enables the operator to accurately adjust his gas to equilibrium with the steel he is treating.

"In furnace development, there has been a strong trend toward integrating the furnace and quenching mechanism wherever possible so as to bring the entire hardening process under automatic control and eliminate exposure to the air in quenching. All this is in the interest of quality control since the heating time and temperature and quenching time and temperature are automatically controlled. Automatic quenching also makes possible the quenching of relatively large parts in the most favorable position to avoid or minimize distortion."

Machinability Improved by Isothermal Annealing

S. L. Widrig, chief metallurgist, Spicer Mfg. Co., Toledo, O.: "Better knowledge of the isothermal transformation diagrams is contributing significantly to scientific advancement in heat treating and manufacture of steel products.

"Formerly, many of us had our own pet steels of which we had gained considerable knowledge through research and experience. These steels served our purposes beautifully back in the times when they were available. However, when forced to use substitute or alternate steels, we were faced with many problems. The new steels did not have the same latitude or range in treatment as the old steels. There were significant differences in dimensional changes or distortion. Using our old standard methods of treatment, we were dissatisfied with the resultant physical properties, machinability, etc.

"Considerable improvement has been made through careful study and use of the isothermal transformation diagrams. This is true not only of the new types of steel but also of the old.

"Isothermal annealing has in most cases improved machinability as well as lowered the cost of the annealing operation. Austempering, or modification of this process, has generally improved the physical properties of the parts treated and decreased the amount of warpage and also the distortion factor.

"Martempering in many cases has also shown marked improvement over former methods in regard to physical properties and dimensional changes. This is particularly true of carburized work.

"Accelerated, or high-velocity quenching, has contributed greatly to the use of the lower alloy steels. Special quenching fixtures which allow the quenching medium to be forced directly on to the work are being used to considerable advantage.

"Heat treating methods and procedure have constantly improved through the years; nevertheless, the greater application of data relative to isothermal diagrams is responsible in a large degree for unusually rapid advancement."

Stress Control Through Proper Heat-Treat Process Advocated

A. L. Neudoerffer, plant metallurgist, SKF Industries Inc., Philadelphia: "In the postwar period there will be a very concentrated effort to improve heat treatment of steel and its alloys. Prior to the war this country was what may be termed "alloy conscious"; that is, certain alloy steels frequently were used for applications where a lower alloy, or even a good quality carbon steel would have been satisfactory. This was done often because of high pressure salesmanship or advertising and not because of sound technical reasons. The use of some of our present National Emergency steels as substitute steels has proven this to be true.

"It seems, therefore, that from an economy standpoint, and because it is going to be necessary to conserve some of our alloying elements which have been often used wastefully, that the tendency will be to obtain desired properties by better heat treatment, rather than by indiscriminate use of various alloy steels.

"Then, too, we are learning more about stress analysis so that future specifications will probably require better heat treated parts, particularly in regard to control of stresses, since it is apparent that too little attention has been given to above factor in the past.

"Better heat treatment will be aided generally by more use of (1) controlled atmospheres and salt baths; (2) better temperature control instruments; (3) wider and more general use of induction hardening; (4) use of hardenability ratings and (5) by better inspection procedures or methods prior to heat treating. There probably will be many other developments, such as quenching techniques or media which will help to obtain better heat treatment. It seems that the future of heat treating holds great promise."

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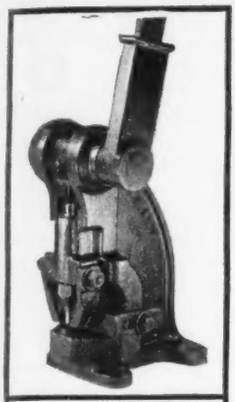

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5/16" x 3/16"	1/2" x 3/16"	1/2" x 7/32"	21/64" 7/32"
1/4" x 3/16"	1/2" x 5/32"	1/2" x 5/32"	5/16" 3/16"
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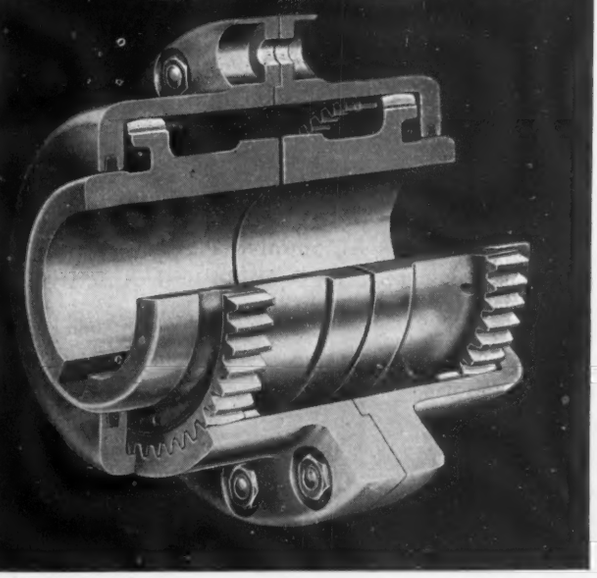

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ENGINEERS OF PRODUCT FINISHES

Surface Treatment

(*Continued from Page* 296)

from the time the wire is drawn to the time it is converted into rope, nails, or other finished commercial product. Rusting of the wire during this period may be prevented by proper coating with a suitable petroleum base product.

"In the reconversion program considerable valuable machinery will be laid up for indefinite periods of time, and it should be mandatory that all parts are properly protected against corrosion. Nonmachined cast surfaces should be repainted, machined parts should be coated with petroleum base specially compounded rust preventive of the proper consistency to resist moisture and temperature variations, while all interior parts, such as gear boxes, bearings, cylinder walls, etc., should be flushed and partially filled with a more fluid type of rust preventive.

"It should be remembered that rust preventives are not rust removers, and effective only when applied to surfaces which are thoroughly clean and dry.

"Ordinary lubricating oils and greases do not provide the necessary protection, and specially prepared petroleum base compounds should be used."

Spring Life Increased 1370 Per Cent by Shot Peening

D. C. Turnbull, chief engineer, American Foundry Equipment Co., Mishawaka, Ind.: "Though not a new development, the impetus of war has advanced shot peening to the point where it is now assuming a leading place among modern industrial processes.

"Amazing increases in service life are attained by putting stressed surfaces in a state of residual compression — by 'stretching' the top layer under a rain of metallic shot thrown at high velocity. The compressed 'skin' counteracts the tension stresses set up under load, so that fatigue cracks do not get a chance to start. It has been found that fatigue failure occurs in tension, not in compression.

"Shot peening of helical springs, for example, produced 1370 per cent life improvement; hypoid gears — 600 per cent; engine crankshafts — 900 per cent; steering knuckles — 475 per cent; welded joint — 310 per cent (according to tests made by General Motors Research Laboratory).

"Postwar applications of this process are expected to be even more extensive. Shot peening affects design considerations in the following ways:

—To lengthen fatigue life of present parts, such as gears and springs, that have been failing prematurely.

—To permit higher stressing of engine parts, thereby increasing the rating of an engine without increase in weight.

—To permit reduction in size and cost of parts, by increased fatigue resistance.

—To cut production costs by eliminating certain operations such as grinding and polishing and, at the same time, to increase the fatigue life.

—To use the same size parts, but made of less expensive steel (requiring less alloy), by added strength due to shot peening."

Shot Peening Often Saves Cost of Polishing Parts

P. J. Potter, executive vice president, Pangborn Corp.: "Sponsored by General Motors Research Corp., shot peening is being used by many manufacturers of aircraft motors, artillery, tanks and other machined steel products to increase the wear life of parts subject to severe stress or shock. The results in most cases have been very satisfactory in that wear life of many items is increased several hundred per cent. The process is very useful and economical where, because of the limitations of the complete design, the part is especially stressed and is subject to failures and cannot be increased in size or weight without involving radical redesign.

"The operation must be done after the part has undergone all required heat treatments and has been machined to finished dimensions. Many precision parts are given a satin finish. This finish is changed by the shot peening process to a matte finish. Therefore, the high cost of polishing can be eliminated. On many items, this saving more than covers the cost of shot peening.

"The process is being carefully studied and applied by many large engineering and metallurgical organizations. Because of the need of decreased weight plus increased strength in rapidly moving parts, it is expected this process will rapidly become a considerable factor in many lines of manufacture."

Very Tough Chilled Iron Shot Produced by Controlled Heating

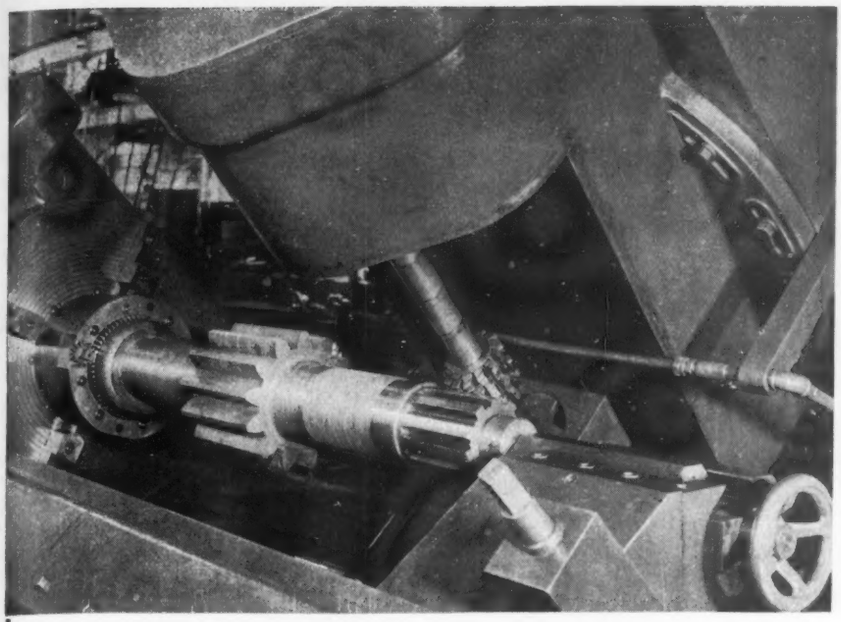
Oscar E. Harder, assistant director, Battelle Memorial Institute, Columbus, O.: "Surface treatment of machine parts by shot peening to increase fatigue resistance continued to make progress during 1944. Work has been started much earlier. To illustrate, during 1943, J. O. Almen had written numerous papers pointing out the benefits to be derived from metal peening, for example, in *Metal Progress,* February, May, and September; *Automotive Engineering,* February; *Product Engineering,* page 348, *Iron Age,* June; *S.A.E. Journal,* July; *Machine Design,* August; and STEEL, Volumes 10 and 14. He also published another paper along this line in *Machine Design,* February, 1944. Numerous laboratories and industrial plants made valuable applications of shot peening, and manufacturers developed special equipment for carrying out the process.

"A shot which has been readily available and which has been most extensively used for peening purposes is a chilled iron shot. It has high hardness but is far from being satisfactory because of brittleness. A limited amount of work has been done with steel shot, mostly in the relatively large sizes, and there is much interest in the production of steel shot. Harder and Gow presented a paper entitled 'Shot for Metal Peening' (ASM Preprint No. 32) and discussed chilled white iron which has been used, but also reported on the properties of a specially heat-treated iron and its application for metal peening. It was shown that, by controlled methods of heat treating a chilled white iron, it is possible to produce shot of much better toughness than chilled iron and within a hardness range up to 500 to 600 Vickers hardness, which is high enough to be applicable to the peening of many machine parts, but there still remains the need for a tougher shot for the peening of machine parts having hardnesses in the range of 50 rockwell C and higher.

"In spite of the many limitations on the materials which are now available for shot peening, progress is being made, and the improvement of fatigue endurance by surface peening is having an important place both in industry and in war materiel, increases in service life of 100 per cent being quite common and increases of from 10 to 15 times being reported."

Automotive Plants Take Up Shot Peening with Alacrity

F. P. Zimmerli, chief engineer, Barnes-Gibson-Raymond Division, Associated Spring Corp., Detroit: "The propelling of small steel or cast iron balls against the outer surface of mechanical parts, called shot peening, not only works the surface but more importantly induces compression stresses. Thus since tension stresses cause most failures, the service life of parts is greatly increased. The first use to which this process was put was on dies in England under the name of cloudburst harden-



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An important operation in Lima Locomotive Works, Incorporated, Lima, Ohio, is the cutting of splines. The picture shows a vertical swing shaft with the National Tool hob cutting splines on a Simplex Hobbing Machine.

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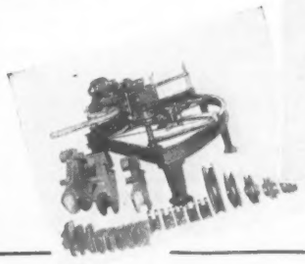

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ing. The spring industry in this country first put the process into commercial production and it was then called shot blasting.

When employed by the spring industry on sound material, this process raised the endurance limits from 40 to 65 per cent. This in turn allowed the use of higher stresses and the design of resilient members impossible heretofore. Helical springs were made of smaller wire, and after peening, gave better performance than the larger unpeened design. The use of alloy steel in sizes less than ⅜-inch diameter became entirely wasteful from a fatigue viewpoint.

"Naturally the process spread from the spring industry into automotive practice. It has been tried and found advantageous for gears, connecting rods, crank shafts, steering arms, universal joint parts, etc Increase in part life under these conditions often runs from a few hundred per cent to fabulous figures, even though increase in endurance limit is small.

"Possible disadvantages of the process also must be considered. As the surface is cold worked, it is obvious that heat will affect it. Our tests have shown that parts heated above 500 degrees Fahr. for as little as 45 minutes lose a little of their shot peened properties and that this loss continues as time and temperature are increased until at 825 to 850 degrees Fahr., peening effect is lost completely.

"Shot peening needs for its further intelligent application a method of measuring its effect on the part itself any place and at any time. The best test at present is the Almen strip sent through the machines with the parts."

Porcelain Enamel To Replace Expensive Alloys in Postwar

G. H. McIntyre, director of research, Ferro Enamel Corp., Cleveland: "The porcelain enameling industry, while curtailed in many ways during the war period, has seized the opportunity to advance technically in many ways. Research and development has been stimulated by the war needs.

"Porcelain enamel has become most important as a corrosion resistant material. Porcelain enamel on iron has replaced alloys and metallic coatings for such uses as airplane exhaust stacks, hot water tanks, chemical equipment, tent hoods and bulkheads on ships. It has proven its ability to withstand high temperatures and corrosion from the elements and against hot water under pressure.

"It will be adapted for replacing expensive metal alloys and other coatings in industrial applications such as for transformer cases, hot water storage tanks, building fronts, and automobile and airplane exhaust systems. For the more common uses on stoves, refrigerators and washing machines, porcelain enamel has been made more durable by increased resistance to impact, thermal shock and corrosion from fruit acids, while retaining all its original beauty and range of colors."

Liquid Flux Technique Opens Door to Machine Galvanizing

Wallace G. Imhoff, president, Wallace G. Imhoff Co., Vineland, N. J.: "There is always a period in any industry when the many technical phases that make up the industry converge to one focal point all at the same time. When they reach that point, it opens up many new and interesting developments. The hot-dip galvanizing industry seems to have reached that stage now, and the future and postwar developments may be startling.

"During the past 25 years, the liquid flux technique slowly and gradually has been perfected to the stage where now these other developments can go forward. For example, the old steel dry plate should be a thing of the past. It has been the direct cause of many of the galvanizer's troubles. It caused corrosion; often the work was 'burned' on the dryer, causing seconds, bare and exposed steel spots. Indirectly, it slowed production and, because of an increased submersion time, greatly increased the weight of zinc used per ton of product. The writer now is sponsoring and has sponsored a new technique of drying for the hot-dip galvanizing industry. It is drying with a hot air dryer. However, this is only practical with the liquid flux technique; it cannot be used with the old muriatic acid dip.

"Another new development which is in the embryo state is a method of preheating the work up to the galvanizing bath temperature without corrosion of any kind. Articles are pickled, washed, put in the liquid flux, and then in the preheat treatment, and finally, in the galvanizing bath.

"This series of developments has solved the problem checking development of machine and mass-production galvanizing. Never before has it been possible to preheat without developing corrosion. New technique completely eliminates all corrosion, and now makes machine and mass-production galvanizing possible in all hot-dip fields."

Times Create Opportunity for Metallizing Many Worn Parts

L. E. Kunkler, president, Metallizing Co. of America, Chicago: "A most significant development in 1944 was the widespread adoption of the metallizing process as a practical and proven means of salvaging worn shafts and its use by some leading industrial plants as a production tool and a means of improving parts and protecting metals from corrosion.

(*Please turn to Page* 402)

Lubrication

(*Concluded from Page* 300)

tem has made possible the continuous operation of several important units which would otherwise necessitate loss of production to provide proper lubrication. In fact, several otherwise inaccessible points of lubrication have been satisfactorily provided for in this manner with a corresponding savings in maintenance and replacement of parts.

"Many of the specialty products of today which have been developed primarily to meet temperature ranges such as minus 60 to plus 300 degrees Fahr. as experienced by the service branches of our Armed Forces throughout the various theaters of war and undoubtedly will find their way into the steel industry and will play a definite part in meeting operational problems of tomorrow."

Greater Importance Attached To Lubrication Engineer

E. J. Ehret, district representative, Farval Corp., Chicago: "The chief lubrication engineer of large steel mills and industrial plants is sometimes tied into the chief engineer's office and in other cases into the general master mechanic's domain, but in effect, he has his own department and is backed up with authority.

"In former years, the average lubrication engineer was charged with keeping tab on the number of barrels of oil that were used and he had little authority. Today, he has assistant lubrication engineers in the various divisions of the plant, each directly responsible to him for the selection and care of the various lubricants and their proper application. Studies are made to see that the correct lubricant is selected and that a proper method of application is provided to insure delivery of the correct lubricant to every bearing on each machine, frequently enough to provide bearing protection at all times. His job is to reduce the number of kinds of lubricants so that the oiler doesn't start to lubricate a machine with a grease gun in one hand and an oil can in the other, but can go to one place and lubricate all the bearings from a safe handy location.

"It has been found that the greatest return from the investment in devices comes when an entire department is set up with one method of lubrication."

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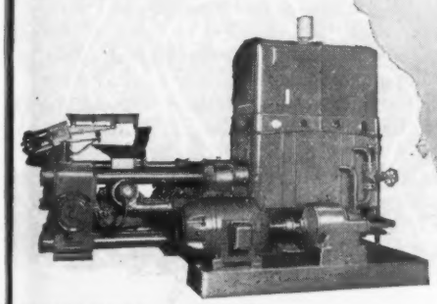

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(*Concluded from Page* 400)

"Automobile manufacturers have found that no trouble was experienced with worn crankshafts built up by metallizing. Lubricating problem was more easily solved, there was less wear, and that in several instances where crankcases ran dry, even though motors were driven 1000 miles, there was no scoring of the shafts. The tiny pores and channels in the sprayed metal on the shafts provided reservoirs for the lubricating oil. Life of the shaft was increased thereby from three to six times.

"Those users of zinc built-up pistons say that when new pistons are available, they intend to machine each one and put a 1/16-inch coating of zinc on the new piston before it is installed.

"Within certain limits foundries are using metallizing equipment to fill in defects in castings."

Wartime Pressure Emphasizes Importance of Composite Metals

L. W. Townsend, superintendent, Composite Steel Division, Jessop Steel Co., Washington, Pa.: "The various combinations of metals continuously and integrally united have received widespread attention because they have been the answer to immediate and urgent needs. No doubt, the critical shortage of various alloying elements contributed to the phenomenal increase in demand.

"Solid metals can be improved upon for some applications by the use of a bimetal combining them with a metal having characteristics not inherent in the solid metal. For instance, in the tool steel field the high alloy steel necessary to get a cutting edge which will stand up under difficult machine work is very expensive both in material cost and in cost of shaping to the required tool. These high alloy steels are also very brittle. To overcome these problems the logical answer is a composite metal body combining the edge-holding quality and high-temperature strength of the high alloy tool steel with the shock resistance, machinability and economy of a low alloy steel."

Foresees Live Market for Synthetic Protective Coatings

Howard E. Wise, president, The Arco Co., Cleveland: "The vastly increased production of many chemicals usable in synthetic enamels augurs well for the user of protective coatings. In all probability not only will the alkyd type synthetic enamels become commonplace after the war, but many new types of coatings based on synthetic resins will make their appearance.

"Considerable of the increased production of phthalic anhydride is now going into DDT type insect repellents areas, but it is problematical whether any considerable portion of phthalic anhydride will go to this use after war. Most of this increased production will be available to the paint industry for alkyd type synthetic resin coatings.

"Other chemicals, such as phenol and maleic anhydride, whose production has been greatly increased, will find an enlarged outlet in the paint industry. These chemicals will permit increased durability, better resistance to moisture, better alkali resistance and other improved features in synthetic enamels."

Developments in Electroplated Lead Will Continue To Grow

Allen G. Gray, Electroplating Division, E. I. du Pont de Nemours & Co. Inc., Cleveland and secretary, Electrodeposition Division, Electrochemical Society: "Current war applications of electroplated coatings are providing valuable information on corrosion resistance and metallurgical characteristic in electroplating. Progress has been made in the study of laboratory methods adapted to evaluation of strip plating solutions. Continued research and development work on electrolytes for strip plating should enable the steel mills to get greater production, better deposits, and significantly lower costs.

"Developments in electroplated lead coatings, given a stimulus by the relatively plentiful metal supply undoubtedly will continue to grow."

Metallurgy

(*Concluded from Page* 380)

many corrosion resisting applications including acid pickling, marine shafts, pumps and accessories, military kitchens, high octane aviation gasoline production, etc. A free-machining grade is readily adapted to screw machine work."

Publication of Specific Handenability Data Helpful

Henry Wysor, metallurgical engineer, Bethlehem Steel Co., Bethlehem, Pa.: "So complex a material as steel has taxed the engineer's knowledge and ingenuity in his effort to develop and test its properties in order to utilize these to the fullest extent.

"Once the treatment is established for a given grade of steel, it becomes possible to simplify the procedure through some simple test from which properties in general are deduced by interpolation. Such a method is the Jominy test.

"Following a careful study of quench results by this method and their relation to other mechanical properties in alloy steels, it is evident that a more simplified procedure may be made possible in selecting steel for parts to be heat-treated.

"It is expected that publication by AISI and SAE of hardenability bands on a number of alloy steels may serve as tentative supplementary specifications and eventually may supplant those based on chemical analysis."

Anticorrosive Value of Silver Encourages Use in Cladding

Robert H. Leach, vice president, Handy & Harman, Bridgeport, Conn.: "The great interest in the industrial use of silver and silver alloys has been one of the outstanding developments in the field of precious metals during the past few years and the future prospects are bright.

"Silver brazing is of particular importance because of the wide diversity of applications in which these alloys have proved to be the most economical and satisfactory method of joining steel and iron, as well as many nonferrous metals.

"An interesting development in the chemical industry has been the use of considerable quantities of silver clad steel in the form of large sheets having a ratio from 10 to 15 per cent silver. The resistance of silver to a large number of corrosive agents is obtained by using this clad material and the strength of the steel backing makes this material available for large autoclaves or equipment where high pressures are encountered."

Low-Temperature Notched Impact Test Fulfills Expectations

J. W. Halley, metallurgist, Inland Steel Co., East Chicago, Ind.: "One of the least conspicuous but most important developments of the past year has been in the increased study and appreciation of the conditions leading to brittle fractures in normally ductile steels.

"Brittle fractures of large sections have been reported in the past and were usually considered unexplainable. For example, an investigation of the tensile properties of large sections at the University of Illinois in 1928 demonstrated that a tensile test of a ½-inch thick plate 20 inches wide broke with no elongation, though standard 1½-inch wide tensile tests cut from the same plate showed good ductility.

"Increased use of welding and the resulting constraint of heavy sections has developed further evidence of the prevalence of brittle fractures. The complex impact tests are being recognized as of value in determining the ability of steel to withstand constraint at normal temperatures."

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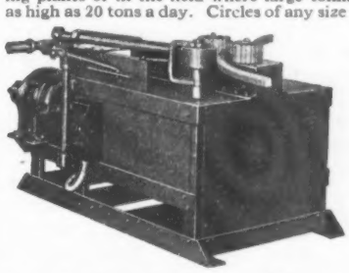

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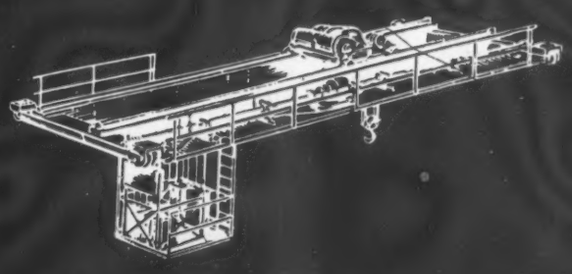

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(Wing Tips)

U. S. Attains Supremacy in Air By Industry's Mass Production

(Continued from Page 244)

all aluminum produced, and last year accounted for something over one billion pounds, or 500,000 tons. Totals for 1943 show aircraft consumption of 1,477,109,000 pounds out of a total of 2,166,583,000; and in 1942 the proportion was 873,343,000 pounds out of a total of 1,395,167,000. Thus in three years, over 1,500,000 tons of aluminum has found its way into aircraft production.

A breakdown of the weight of metals required in the airframe (engines not included) alone of a typical combat or fighter plane shows the following:

	Pounds	Per cent
Carbon steel	930	12.4
Alloy steel	1655	22 0
Brass	100	1.3
Copper	25	0.3
Aluminum	4790	64.0
Total	7500	100.0

Looking ahead to postwar markets, the aviation industry recognizes a high degree of deflation from today's manufacturing level is inevitable. It feels that if it can continue operation on the basis of 5-10 per cent of the present volume, profits can be realized and a fair degree of employment provided. Future sales fall in the following categories:

1. Military planes for the maintenance of a strong air force, calling for about 20 per cent replacement of the total first-line air fleet annually.

2. Commercial transports for both freight and passenger service. These would be broken down into three further types of planes : Supertransports for transoceanic and transcontinental travel; conventional two-engine and four-engine transports for intra-continental services and smaller transport craft for use in feeder-line operations.

3. Personal-type airplanes for business and pleasure travel.

Maintenance of the military market depends on congressional appropriations and there is every likelihood they will continue to be made at least for the next 5-10 years. In the transport field, there will be perhaps 10,000 surplus military planes of this type for disposal and until this obstacle has been removed, new commercial transports will be concentrated principally in the field of the larger units, such as the Lockheed Constellation, the Boeing Stratocruiser, the Martin Mars and the Consolidated Model 39. In fact, a number of airlines have placed orders for these sky cruisers for early postwar operation. The Martin and Lockheed versions are in production, although assigned for the moment to the military.

Sales outlook in the feeder-line type of plane is good, but there is urgent need for a nation-wide program of construction of airports, airstrips, airparks and airharbors, along with transports permitting lower operating costs.

Air cargo and air mail prospects in the immediate future are fair, although both are thought by conservative observers to be over-rated. In 1941, airlines carried 26 billion pound-miles of mail. In the 12 months ending last Aug. 31, war urgency had raised this to 91 billion pound-miles. Enthusiasts are now talking 150 billion pound-miles of nonlocal first class mail, which seems hardly likely without reduction in rates.

Air cargo and air mail pound-miles combined in 1939 accounted for only 0.002 per cent of total inland intercity freight traffic. Like air mail, air express zoomed from 6 billion pound-miles to 32 billion pound-miles last year, but is still only a bare fraction of total freight movement.

Airlines back in 1942 ran up a total of 1.5 billion revenue passenger miles, and were forecasting 6 billion miles by 1946. Lack of equipment has held down increases, although the 300 transports now in commercial operation are running with a far better percentage of payload than ever before, along with many more miles per day travel. As aircraft and operating efficiency improve, one authority predicts passenger rates will drop from the present 5 cents a mile to 4 cents, and eventually may get down to 2 cents a mile. Crux of the problem is simply obtaining sufficient volume of passengers.

In the market for personal-type airplanes, where some aviation enthusiasts profess to see 150,000 sales, a determining factor again will be costs. The average prospective purchaser expects to buy an 1800-pound airplane for $1500-$2500, yet, taking into consideration performance characteristics and extras which the average buyer has indicated he wants, the price currently would be nearer $13,000. Outlook in production is for still higher costs rather than more economy.

High insurance rates, high financing costs, and a maze of regulatory measures covering personal flying, some of which appear needlessly complex, obscure the outlook for any mass exodus to air transportation.

Reassuring is the fact virtually all elements of the aircraft manufacturing industry are entirely realistic in their outlook. They are content to return to the prewar stature of a small industry. They know the future holds much promise, but they admit it cannot be achieved overnight, even under the whiplash of war.

ENGINE PRODUCTION

	Total No. aircraft engines shipped	Total engine H.P. excl. spares (000)	Total engine H P. incl. spares (000)	Average H.P. per unit
1941	50 684	46 202	50 747	912
1942	136 787	142 638	172 566	1.043
1943	226.561	262,036	339 538	1,157
1944				
Jan.	22 627	29.612	36 098	1.309
Feb.	21 067	27 129	35 079	1.288
Mar.	23 923	31 909	39 235	1.334
Apr.	22 681	30.459	37,392	1 343
May	22 819	31 875	38 126	1.397
June	23.072	32 786	38 502	1.421
July	22 603	32 539	36 570	1.440
Aug.	24 102	34.989	39 879	1,452
Sept.	20.881	30 886	35 294	1.477
Oct.	19 268	26.755	30 668	1.389
Nov.	18 500*	26 800*	29.500*	1,450*
Dec.	17.200*	25,700*	29,000*	1,475*
'44 Tot.	258,743†	361,439†	425,343†	1,397†

*Estimated.
†November and December estimated.

AIRFRAME PRODUCTION

	Total number airplanes accepted	Total airframe wt. excluding spares (000,000 lbs.)	Total airframe wt. including spares (000,000 lbs.)	Average wt. per complete airframe lbs.
1941	19.290	76.1	85.7	3,945
1942	47,873	253.1	292.6	5,287
1943	85,946	645.9	743.0	7,515
1944				
Jan.	8,789	78.5	93.0	8,932
Feb.	8.760	81.4	94.6	9,292
Mar.	9 117	89.1	101.4	9,773
Apr.	8 343	82.4	96 4	9,877
May	8.902	89.8	102 4	10.087
June	8,049	84.4	97.8	10.486
July	8.000	80.5	93 9	10.062
Aug.	7,939	79.7	93.9	10,064
Sept.	7.598	78.9	90.0	10 384
Oct.	7,429	75.4	87.8	10,149
Nov.	6.747	71.6	84.2	10,612
Dec.	6,805*	73.0*	85.5*	10,700*
'44 Tot.	96,478†	964.7†	1117.9†	9,980†

*Estimated. †December estimated.

New Type Plating Rack at Martin Plant Efficient

A new type plating rack is saving untold manhours in the handling of small aircraft parts at the Glenn L. Martin Co., Baltimore. Extremely simple in construction, the new rack does away with the individual hanging of numerous small parts and at the same time insures that the surface to be plated faces the anode, thus guaranteeing uniformity of metal deposit and cutting down on rejects due to uneven coating. A further advantage is that they provide a safe, efficient means for draining parts as they are removed from the baths while protecting the operator's hands and clothing from the caustic solutions.

The basic design of the rack consists of a tubular metal frame work across which wire mesh is stretched in the manner of an old fashioned bed spring. Some of the frames are covered with chicken wire and others with a larger mesh material to accommodate various size parts. The mesh covered frame is attached to another piece of pipe by two arms with pivots slightly above mid point so that it can be easily tilted in either direction.

Wickes UNIVERSAL CRANKSHAFT LATHES

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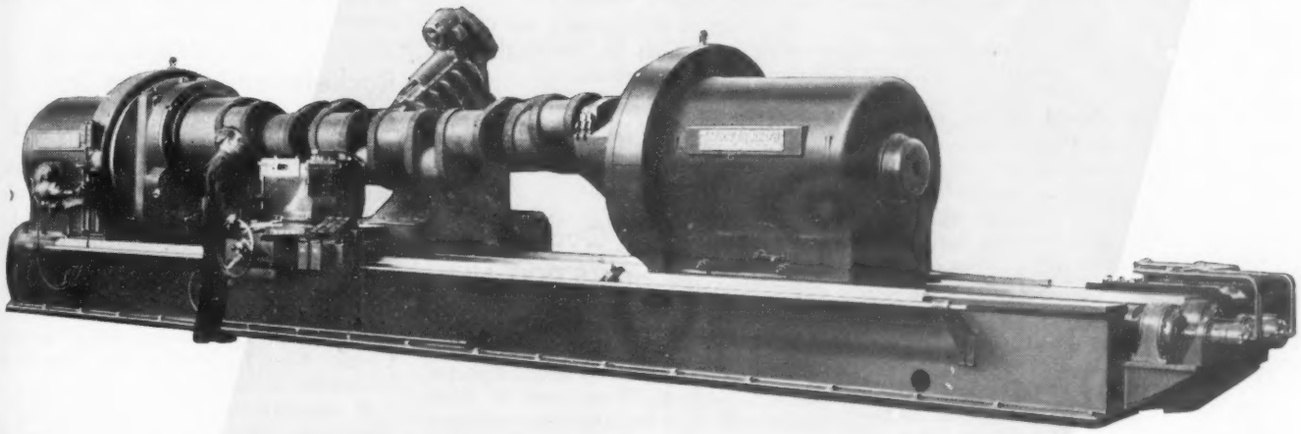

Wickes Universal Crankshaft Lathes are especially designed for machining main line bearings and crankpins on all sizes and types of crankshafts such as gas engine, automobile, tractor, airplane, and Diesel crankshafts. All crankpins and intermediate main bearings can be turned on a single machine of the Double End Drive type shown above in Model UH-60 size. All main bearings can be turned on a single machine of the Single End Drive type. All lathes equipped with independent hydraulic feed to the carriage and to the cross slide. Wickes Universal Crankshaft Lathes are built both Double End Drive and Single End Drive in four sizes (Models UH-4, UH-8, UH-60, and UH-72) for turning all sizes of Crankshafts.

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Organized Labor Emerges in 1944 As Major Political Factor in U. S.

(*Concluded from Page* 187)

10. Enactment, later on, of a "post-war" tax measure with taxes levied in accordance with ability to pay; corporations, instead of being relieved of income taxes, as some groups recommend, should bear their fair share of the tax load; a minimum amount of income considered necessary to maintain a standard of living at "a level of health and decency" should be exempt; small businesses and new corporate enterprises should receive tax benefits; excise taxes should be eliminated gradually; estate and gift taxes should be integrated to prevent tax evasion; payroll taxes for unemployment insurance and other forms of security should be eliminated and "the cost should be borne by all society and should be paid for by contributions from employers to the government."

11. Repeal of "antilabor" laws in Alabama, Kansas, Texas and Colorado.

The CIO is squarely on record to support a program of full employment for war veterans. The CIO is behind a program to guarantee fair prices to the nation's farmers. It recently went on record as opposed to the proposed "Equal Rights Amendment" on the ground it would "endanger the minimum pay laws, laws governing night work for women and all other legislation that has been enacted to safeguard the health and well-being of women workers."

The fact that the above list of objectives on the CIO agenda fails to include Philip Murray's demand, early in 1941, for the establishment of industry management committees or boards should not be taken to indicate that this demand is dead. This continues a very live issue; in fact, it goes right to the heart of the basic CIO demand which is that labor should have a share in the management of industry.

This policy of direct action is reflected in other ways, notably when the CIO is dissatisfied. When the CIO waxes critical it makes no attempt to dissimulate or use soft words.

For example, the National War Labor Board is regarded generally as having dealt kindly treatment, on the whole, to the CIO. Nevertheless, the WLB did make some decisions that were not to the liking of the CIO. When the CIO got around to formulating resolutions at its November convention, it ignored anything in the record it had found good and concentrated on what it had found to be bad.

Of the CIO proposals, undoubtedly the most important from the standpoint of their effect in shaping up the future complexion of American business are the ones for an extension of price and wage controls into the reconversion period. It is fair to assume, however, if history is any guide in this instance, that the CIO will favor a permanent system of government price and wage controls.

In the second place, the CIO record has been a consistent one in urging Congress to enact its demands into laws, and heads of administrative agencies to implement them by means of rulings and interpretations. The chances are that the CIO eventually will come out for a permanent government policy of controlling prices and wages.

To get its program across, the CIO is working not merely in Washington but in the country as a whole.

The CIO in 1944 expanded its public relations work; it is satisfied with the results, and plans to spend more money in such work in 1945.

Electric Range Quarterly Quotas Set at 35,000 Units

Production of 35,000 domestic electric ranges per quarter has been approved for 1945, War Production Board reported recently. About 35 per cent of these ranges will go to the armed services and the National Housing Agency, the remainder to institutions and individual consumers who certify need and can show that no additional wiring will be required on their premises. The industry has requested that they be permitted to place advance orders for materials, with AA-3 rating, to provide for prompt delivery when reconversion becomes possible.

(Windows of Washington)

Many Pressing Problems Confront 79th Congress

(*Concluded from Page* 226)

Committee which has been very active during the past two years in ordering employers to engage workers without discrimination as to race. Whether Congress will accede to this request remains to be seen. Repeal of the Connally-Smith act also will be demanded, but with no assurance the demand will be granted.

Unless the new Congress provides funds for the Census Bureau, certain needed business information will not be made available. When the Bureau of the Budget, at the demand of the President, recommended that the Census Bureau be authorized to conduct a census of manufacturers, a sample census of retail sales, a consumer income survey, and an expansion of the regular monthly labor force survey to show employment, occupations, etc., all for 1944, no request was made for funds to finance the regular 2-year census of manufactures for 1945, and the regular census of business for 1945. It was considered that in view of the data to be obtained from these special censuses the regular censuses might be omitted.

In view of the House action in refusing to finance the special censuses, the Census Bureau now is without funds to make any of these investigations.

Another angle businessmen may well bear in mind in speculating on the possible behavior of the new Congress is the fact that the old trick of incorporating new legislation in appropriation bills has undergone a revival of late. Thus, appropriations passed by the 78th Congress included such provisions as school lunches and subsidies to food processors. It is entirely likely that more such gravy dispensations may be included in the 12 major appropriation bills which will be passed during the first half of 1945.

Rockefeller Holdings in Colorado Fuel & Iron Sold

Allen & Co. and Associates, New York, have purchased the holdings in Colorado Fuel & Iron Corp., Denver, of John D. Rockefeller Jr. and Rockefeller Center Inc., estimated at $13 million.

These holdings consist of 283,980 common shares, constituting control, and $5,747,600 of the corporation's bonds, Charles Allen Jr., head of the New York investment house states.

It was indicated that purchase of the Rockefeller holdings in Colorado Fuel & Iron Corp. do not involve any present plans for consolidation of Colorado Fuel & Iron with Wickwire Spencer Steel Co., Buffalo, of which Mr. Allen is chairman of the board.

Construction of Mexican Refinery Proceeding Rapidly

Construction work for the Mexican government's new 100-octane aviation gasoline refinery, which is being erected at Atzcapotzalco near Mexico City, is proceeding rapidly, Harold L. Ickes, petroleum administrator for war, reports. Orders for 60 per cent of the equipment and materials have been placed and engineering work is well along.

The United States government will have the first rights to purchase part of the output of aviation gasoline and certain other products. The cost of the entire project will exceed $15 million and arrangements have been made for the purchase of materials and equipment here to be financed by a $10 million loan from the Export-Import bank.

Temple To Design, Develop Products for Trends Inc.

William F. Temple, supervising analyst of the Priorities Branch, War Production Board, during its first year of operation in Cleveland, has become associated with Trends Inc., United Bank building, Cleveland. He was formerly district sales manager for SKF Industries Inc., and later sales manager of Towmotor Inc., also of Cleveland. His new work will involve the designing and developing of industrial products.

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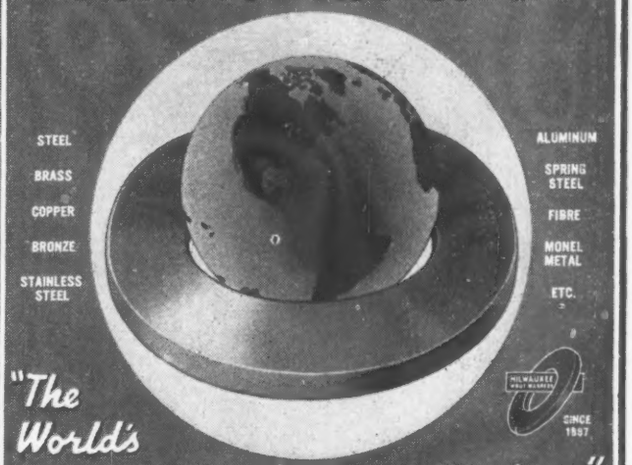

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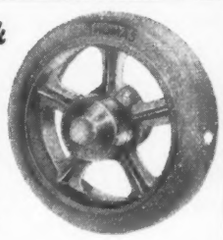

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WPB To Penalize Violators of WMC Rules on Hiring

REGULATION providing for withdrawal or modification of priority ratings or allocations for materials held by any employer who fails to comply with an employment ceiling or hiring regulation established by the War Manpower Commission was issued last week by the War Production Board. This action was taken on instructions from James F. Byrnes, director, War Mobilization and Reconversion, who directed WMC to intensify its drive to establish employment ceilings in critical war areas and directed WPB to use its controls over materials and priority ratings to support WMC rulings.

Under terms of this order, plants which ignore rulings of the WMC will be reported to the WPB which will arrange for a hearing on the complaint. If the employer is found to be a willful violator, WPB will revoke or modify his priority ratings or materials allocations.

Invoking of the government's wartime powers over priority ratings and the allocation of materials was necessary to assure a manpower supply to permit full utilization of the facilities and materials available for war production.

Majority Co-operating

"The vast majority of establishments and employes are co-operating wholeheartedly with the WMC in accepting employment ceilings as essential to war production," Mr. Byrnes said. "I am sure that we can continue to establish these ceilings in most instances through negotiations with the establishments and services concerned with their employes on a voluntary basis.

"However, I am unwilling to ask for the voluntary acceptance of ceilings by the many without being prepared to take positive measures to enforce ceilings on the very few who are unwilling to thus contribute to our war effort."

The order issued by WPB, read in part as follows: "Any priorities or allocations granted by or under authority of the WPB may be withdrawn or modified at any time when the WPB makes a finding that materials or facilities are not being used most effectively for the prosecution of the war as a result of a failure to comply with an employment ceiling or hiring regulation of the WMC. Priorities or allocations will be withdrawn or modified . . . only after the WMC has certified that an employer has refused to comply with an employment ceiling or hiring . . . If, in the opinion of WPB, materials or facilities are not being used most effectively for the prosecution of the war as a result of the failure to comply, it will institute proceedings before one of its compliance commissioners to determine whether there is a proof of this, and will give the employer appropriate notice and opportunity for a hearing."

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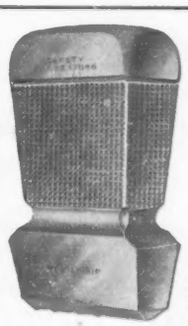

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EARLE D. McKAY

GARDNER STEBBINS

R. CONRAD COOPER

R. A. Williams has been placed in charge of sales, American Car & Foundry Co., New York, succeeding **William L. Stancliffe,** resigned, who remains with the company in a consultive capacity and continues as a director. Mr. Williams was elected a vice president of the company in December, 1943, and has been Mr. Stancliffe's chief assistant in the sales organization.

—o—

James W. Tyson II has been elected vice president, Eastern Gas & Fuel Associates. In 1934 Mr. Tyson became assistant treasurer, Koppers Coal Co., later the Koppers Coal Division, Eastern Gas & Fuel Associates. He will continue to make his headquarters in Pittsburgh.

—o—

Elliott R. Vinson has been appointed electronic tube specialist for the Pacific Coast Division, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

—o—

W. M. Laughton has been named general manager of the San Francisco and Alameda, Calif., yards of Bethlehem Steel Co.'s Shipbuilding Division.

—o—

J. P. Lawton has been named district commercial manager for the northwestern district, Graybar Electric Co. Inc., New York. He will make his headquarters in Seattle. Mr. Lawton succeeds **J. H. Kelly,** who is retiring after 38 years with the company.

—o—

Edwin H. Johnson has been appointed to the newly-created position of chief engineer of mines, Republic Steel Corp., Cleveland. For the past nine years Mr. Johnson has been serving as a mining engineer, Mining Sales Division, Jeffrey Mfg. Co., Columbus, O.

—o—

James King has been appointed field sales engineer in the New York factory branch for General Controls Co., Glendale, Calif.

—o—

L. D. Fowler has been named assistant manager of sales, Integral-horsepower Alternating-current Motor Section, Motor Division, General Electric Co. He will remain at the Oakland, Calif., works, where he will be in charge of the general office commercial activities in connection with the manufacture of electric motors there.

—o—

Earle D. McKay has been named assistant vice president in charge of industrial relations, Wheeling Steel Corp., Wheeling, W. Va., succeeding **R. Conrad Cooper,** who has joined United States Steel Corp., Pittsburgh.

—o—

Gardner Stebbins has been appointed general sales manager, Shaw-Box Crane & Hoist Division, Manning, Maxwell & Moore Inc., Muskegon, Mich. Mr. Stebbins has been associated with the company for 14 years, and until closing of their Mill Supply Division at Jersey City, N. J., he was sales manager of that division.

—o—

R. Don Harris has been appointed southwestern district manager, Radio Receiver Division, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., and will make his headquarters in St. Louis.

—o—

Dr. Charles F. Kettering, vice president of General Motors Corp., Detroit, has been elected president of the American Association for the Advancement of Science.

—o—

Edward S. Christiansen has formed the Edward S. Christiansen Co., 160 North La Salle street, Chicago 1, to deal in magnesium and aluminum scrap and finished materials. For the past three and one-half years Mr. Christiansen has been a principal stockholder and has held the offices of vice president, director and sales manager, Apex Smelting Co., Chicago.

—o—

W. A. Smith has been named manager of suspension sales, Industrial Products Sales Division, B. F. Goodrich Co., Akron, O.

—o—

Archer W. Richards, who was general manager, Geometric Stamping Co., Cleveland, until he joined Smaller War Plants Corp. as director of subcontracting, Fifth region, has been appointed vice president in charge of contracts, Designers for Industry Inc., Cleveland.

—o—

R. Conrad Cooper has been appointed assistant vice president, industrial relations, United States Steel Corp., Pittsburgh. Previously Mr. Cooper was assistant vice president of Wheeling Steel Corp., Wheeling, W. Va.

—o—

L. R. Boulware, former operations vice chairman, War Production Board, has been appointed to the staff of **Charles E. Wilson,** president of General Electric Co., Schenectady, N. Y., as a consultant on marketing and merchandising. **N. R. Birge,** a vice president of the company who for many years was responsible for operations of GE affiliated companies, retired Dec. 31. Mr. Boulware assumes responsibility for the GE affiliates.

—o—

R. H. Luebbe, assistant manager of the appliance and merchandise department in charge of legal matters, and previously assistant general counsel, General Electric Co., Schenectady, N. Y., has been elected a vice president and general counsel, succeeding the late Darius E. Peck. **Joseph E. Kewley** has retired as vice president and general manager of the Lamp Department, Nela Park, Cleveland, and **M. L. Sloan** has been elected vice president to succeed him.

—o—

Dr. Max Muller, formerly superintendent of refractories, Basic Magnesium Inc., Las Vegas, Nev., has been placed in charge of the research and experimentation department, Titan Abrasives Co., Chicago.

—o—

Cardox Corp., Chicago, has announced the following changes and additions to the sales staff of its Fire Division: **J. H. Krallmann,** district manager for the territory including eastern New York, northern New Jersey and all of New England; **William C. Powell,** district manager for the territory including Indiana, Kentucky, and most of Ohio; **Goodwin N. Roberts,** district engineer for Illinois, northwest-

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ern Indiana and Wisconsin, in association with **J. W. Long,** district manager; **Arthur W. Espey,** district engineer in Pennsylvania, Delaware, Maryland, West Virginia, western New York and southern New Jersey, working with **F. C. Rodgers,** district manager.

—o—

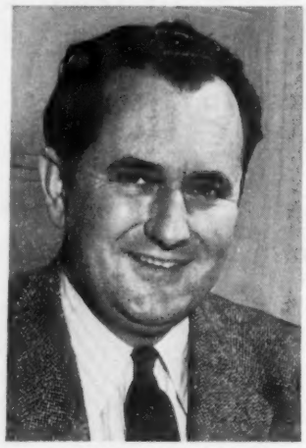
A. N. Phillips, purchasing agent, Schwitzer-Cummins Co., Indianapolis, has been elected president of the Purchasing Agents Association of Indianapolis Inc., and **Clifford C. Harmening,** purchasing agent, Shell Oil Co., is vice president of the Indianapolis association.

—o—

O. B. Wilson has been named New York industrial manager, Brown Instrument Co., Philadelphia, and **J. A. Robinson** has been appointed industrial manager of the Chicago branch, succeeding Mr. Wilson.

—o—

Dr. Franklin D. Smith has been appointed assistant director of development, Organic Chemicals Division, Monsanto Chemical Co., St. Louis, and **David L. Eynon Jr.** has been made assistant to the general manager, Organic Chemicals Division. **Robert K. Mueller** succeeds Mr. Eynon as plant manager of the company's Longhorn Ordnance Works, Karnack, Tex., and in turn is succeeded by **Robert M. Morris** as general superintendent of production at Karnack.



GEORGE C. FORD

Who has been appointed works manager at the Downey, Calif., plant, Consolidated Vultee Aircraft Corp., noted in STEEL, Dec. 25, p. 58.

—o—

William H. Weimer, formerly executive vice president, has been elected president of Davis & Thompson Co., Milwaukee. **G. L. Otto,** for the past 12 years chief engineer, succeeds Mr. Weimer as vice president In this position Mr. Otto will direct all engineering and development work.

—o—

E. R. Brodeen, formerly assistant works manager, Balcrank Inc., Cincinnati, has been named plant manager, Molded Plastics Division, Continental Can Co., Cambridge, O. Other appointments in that division include: **V. E. Robbins,** general accountant; **K. W. Bromley,** chief engineer, and **W. E. Crowther,** personnel manager.

—o—

Edmund A. Georgi, formerly manager of technical development, Papermakers Chemical Department, Hercules Powder Co., Wilmington, Del., has joined Pennsylvania Salt Mfg. Co., Philadelphia, as director of Special Products Division.

OBITUARIES . . .

Lloyd R. Smith, 61, chairman, A. O. Smith Corp., Milwaukee, and one of the nation's leading industrialists, died Dec. 23 in Milwaukee. Mr. Smith was largely instrumental in developing the business from a small baby carriage and bicycle plant into a $20,000,000 corporation that manufactured a large percentage of the nation's automobile frames and welded piping. Mr. Smith joined the corporation in 1905, becoming president in 1913 and chairman in 1936.

—o—

Alfred E. Lindau, 69, an engineer serving the United States Navy, Bureau of Yards and Docks, for the past four years in Hawaii, died there Dec. 14. Mr. Lindau was associated with Corrugated Bar Co. Inc., Chicago, for 19 years, resigning as vice president and director in 1924 to organize, with J. T. Hanley, the American System of Reinforcing as an affiliate of American Wire Fence Co., Chicago, which company was liquidated in 1939. Mr. Lindau was a past president of the American Concrete Institute.

—o—

Frank B. Archibald, 75, vice president, National Lock Washer Co., Newark, N. J., died Dec. 19 in New Rochelle, N. Y. Mr. Archibald had joined the company 40 years ago.

—o—

Dr. Paul M. Lincoln, 74, former head of the school of electrical engineering, Cornell University, Ithaca, N. Y., died Dec. 20. Dr. Lincoln, a fellow and past president of the American Institute of Electrical Engineers, received the John Scott Medal from the Franklin Institute in 1902 for his invention of a synchronism indicator. He also invented a demand meter for measuring electric power and founded the Therm-Electric Meter Co. Inc., Ithaca, to produce the latter device.

—o—

Arthur C. Kennen, 46, secretary and cost accountant, Wheeling Machine Products Co., Wheeling, W. Va., for more than 25 years, died Dec. 16.

—o—

George S. Van Gelder, 66, engineer in the Ordnance Division, War Department, died Dec. 19 in New York.

—o—

Joseph Clayton Sherman, 52, a personnel executive for Consolidated Vultee Aircraft Corp. at its San Diego, Calif., plant, died recently in Phoenix, Ariz.

—o—

Clarence Philip, 51, superintendent, Vascoloy-Ramet Corp., Waukegan, Ill., died Dec. 21 in that city.

—o—

Robert Radford, 65, who was president of the Yellow Jack Mines Co. and chairman of the Southwark Foundry & Machine Co. when he retired ten years ago, died Dec. 16 in Philadelphia. He had served as secretary to the late John J. Converse, president of Baldwin Locomotive Works, and as treasurer and vice president, Standard Steel Works.

—o—

Dr. Charles F. Scott, 80, professor emeritus of electrical engineering at Yale university and a consulting engineer of Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., during his 22 years as chairman of the department of electrical engineering at Yale, died Dec. 17 in New York. Before going to Yale Dr. Scott had been chief electrical engineer for Westinghouse. In 1901 he was president of the American Institute of Electrical Engineers.

—o—

James D. Sample, 59, executive vice president, McWane Cast Iron Pipe Co., Birmingham, and vice president of the Pacific States Cast Iron Pipe Co., Provo, Utah, before his retirement early in 1944, died Dec. 7 in Birmingham.

—o—

Henry G. Ellis, president, Torrington Mfg. Co., Torrington, Conn., died Dec. 1.

—o—

Edwin J. Roberts, 55, construction engineer, Kilroy Structural Steel Co., Cleveland, died Dec. 22 in that city.

—o—

Mark Kuehn, 76, an employe of National Malleable & Steel Castings Co., Cleveland, for 53 years, died Dec. 23 in Abilene, Tex. He had been purchasing agent for both the Toledo, O., and Cleveland plants of National Malleable, retiring about a year ago.

—o—

John William White, 66, sales manager, Remington Rand Inc., New York, died Dec. 22 in Orange, N. J.

—o—

Svend E. Johannesen, 79, an experimental expert on electrical transformers, who retired in 1932 after 16 years with General Electric Co., Schenectady, N. Y., died Dec. 22 in Yonkers, N. Y. His other affiliations included Wagner Electric Mfg. Co., St. Louis, and Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

—o—

George C. Rohr, 62, a department manager for Harnischfeger Corp., Milwaukee, for the past 40 years, died Dec. 19 in Milwaukee.

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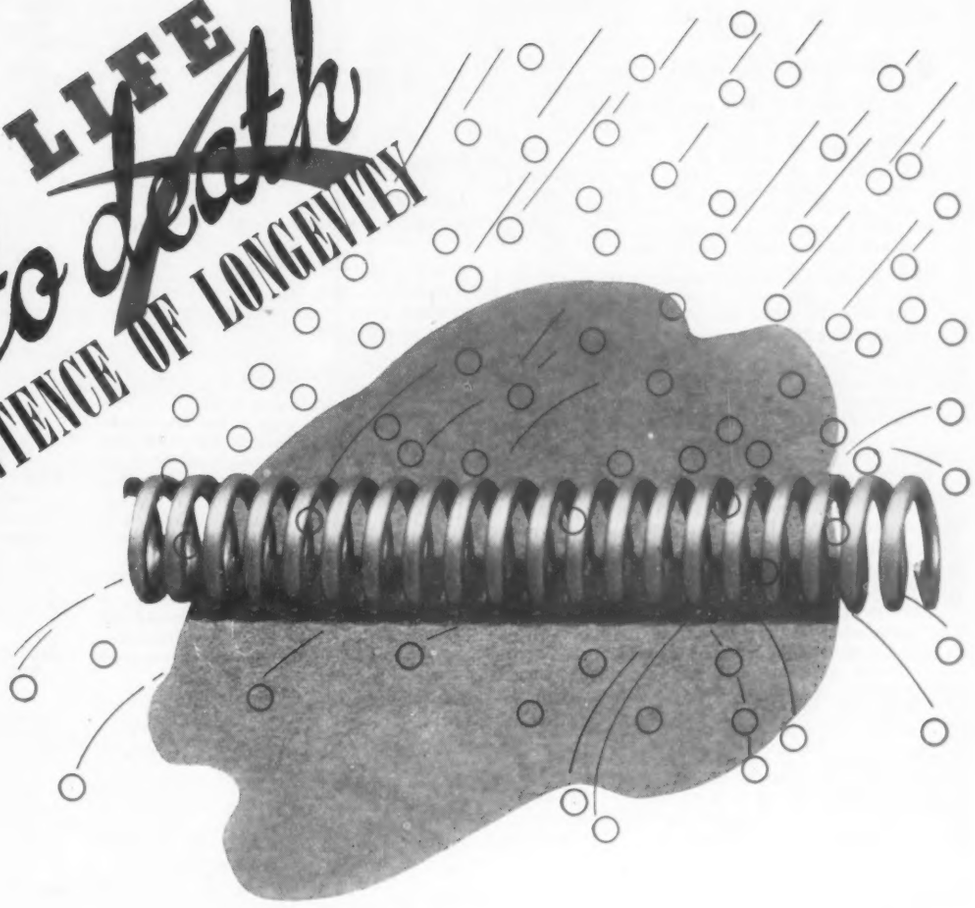

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CONSTRUCTION AND ENTERPRISE

OHIO

ALLIANCE, O.—Transue & Williams Steel Forging Corp., 562 West Ely street, stamping division, will erect a building for manufacture of acetylene gas, at cost of about $10,000.

CLEVELAND—General Heat Treating Co., care A. C. Landstrom, 1529 East Forty-ninth street, will build a one-story 60 x 163-foot heat treating building and office at 941 Addison road, costing about $25,000.

CLEVELAND—American Screw Products Co., 2470 East Ninety-third street, will erect a one-story 40 x 113-foot machine shop addition costing $10,000.

CLEVELAND—Aluminum Co. of America, Gulf building, Pittsburgh, O. J. Robinson, superintendent of construction, 2210 Harvard avenue, Cleveland, will build an addition costing about $16,181.

ELYRIA, O.—Central States Tool Co., 625 Broad street, has been incorporated with $1000 capital and 250 shares no par value to manufacture tools, jigs, fixtures and other machine products, by Charles S. DePuyster and associates, 135 Marseilles street, who is also agent.

LISBON, O.—National Brass & Copper Co. has reorganized with a Delaware charter, with $450,000 capital. J. D. Hart is president, George A. Hempstead, vice president, John Chillick, secretary-treasurer. Phoenix Securities Co., New York, held all outstanding stock, which it sold to the new company.

MANSFIELD, O.—Great Lakes Steel Co., Stran-Steel Division, 11 Longview avenue, will erect a plant building for steel fabrication, at cost of about $23,900. Construction will be started at once.

MASSACHUSETTS

CANTON, MASS.—Plymouth Rubber Co. Inc., Revere street, has let contract to Horn Bros. Inc., 23 Miner street, Boston, for a two-story 60 x 100-foot factory building, to cost about $40,000. A. J. Carpenter, 420 Boylston street, Boston, is architect.

SPRINGFIELD, MASS.—General Webbings Corp., 235 Mill street, will take bids in the spring for a two-story 80 x 162-foot mill addition costing about $75,000. J. H. Bigelow, 14 Irvington street, is architect.

SPRINGFIELD, MASS.—American Bosch Corp., 3664 Main street, has let contract to Ernest F. Carlson Inc., 1694 Main street, for a one-story 90 x 115-foot testing plant, estimated to cost about $100,000.

CONNECTICUT

NORWALK, CONN.—Norwalk Tire & Rubber Co., Winnipauk, Norwalk, has plans by Fletcher Thompson Inc., 211 State street, Bridgeport, Conn., engineers, for a two-story, 80 x 100-foot factory building costing about $60,000.

STRATFORD, CONN.—Baird Machine Co., 1700 Stratford avenue, has let contract to Geilatly Construction Co., 25 Housatonic avenue, Bridgeport, Conn., for a one-story 70 x 125-foot plant to cost about $40,000.

PENNSYLVANIA

MEADVILLE, PA.—Talon Inc., 626 Arch street, will install new equipment and additional wiring, at cost of $23,000.

NEW CASTLE, PA.—F. W. Walker Co., 426 Croton avenue, P. O. Box 216, has let contract to Salem Engineering Co., Salem, O., for altering a two-story building and installing 480 frozen food lockers, to cost about $40,000.

SHARON, PA.—Westinghouse Electric & Mfg. Co., G. H. Parkman, director of building construction, Maloney building, Pittsburgh, has let contract to Joseph Bucheit & Sons Co., 819 Mahoning avenue, Youngstown, O., for a one-story 40 x 100-foot plant addition, estimated to cost about $60,000.

MICHIGAN

DETROIT—Metal Products & Mfg. Co., 20530 Hoover avenue, has plans by I. M. Lewis, 1704 Cadillac Square building, for a metal-working plant addition to cost about $55,000.

ILLINOIS

PETERSBURG, ILL.—Menard Electric Co-operative, Petersburg, plans service extensions costing about $50,000.

MISSOURI

ST. LOUIS—Midwest Pipe & Supply Co., 1400 South Second street, zone 4, has let contract to Fruin-Colnon Contracting Co., 502 Merchants-Laclede building, two-story 50 x 60-foot plant addition, estimated to cost about $40,000, with equipment. P. R. Ramsay, 101 Arthur avenue, Webster Groves, Mo., Zone 19, is architect.

ARKANSAS

HARRISON, ARK.—Missouri & Arkansas railway, R. C. Lowrey, chief engineer, Harrison, will rebuild a machine shop recently burned, to cost about $40,000.

PINE BLUFF, ARK.—Arkansas Power & Light Co., Pine Bluff, will build 92 miles of electric power transmission lines in Stone county at cost of about $100,000.

WISCONSIN

BELOIT, WIS.—Wisconsin Power & Light Co., 122 West Washington street, Madison, Wis., is having plans prepared for an addition to the generating plant here and changes in transmission system, at cost of $2,968,492.

EAU CLAIRE, WIS.—White Machine Works, 759 Wisconsin street, has let contract to Hoeppner-Bartlett Co., 631 East Madison street, for a one and two-story foundry and three-story pattern shop, estimated to cost $30,000. A. A. Wickland & Co., 205 North Wacker drive, Chicago, are engineers.

MARINETTE, WIS.—Marinette water department has let contract to Pittsburgh-Des Moines Steel Co., 38 South Dearborn street, Chicago, for fabricating and erecting a 400,000-gallon elevated water tank, to cost about $31,000.

MINNESOTA

MORA, MINN.—Land O'Lakes Creameries Inc., L. L. Getten, production manager, 2201 Kennedy street, NE, Minneapolis, has plans by M. O. Buetow, 1931 University avenue, St. Paul, for one and three-story milk dehydrating plant 110 x 134 feet, to cost $150,000.

TEXAS

DALLAS, TEX.—Griffin Tank & Welding Service, 3027 Elm street, plans construction of a shop costing about $40,000.

HOUSTON, TEX.—Texas-New Mexico Pipeline Co., 720 San Jacinto street, will lay 30 miles of 12-inch loops between Crane and Houston, Tex., at cost of $100,000.

MIDLAND, TEX.—Metropolitan Natural Gas Co care C. V. Lyman, Midland, plans constructioin of a natural gasoline plant to cost about $2,000,000.

IDAHO

NAMPA, IDAHO—Idaho Concrete Pipe Co., recently organized, will erect a plant 80 x 80 feet, which will cost about $36,500, with equipment.

COLORADO

DENVER—Gates Rubber Co., 999 South Broadway, has let contract to F. J. Kirchhof Construction Co, 700 Lawrence street, for a four-story manufacturing plant to cost about $450,000.

CALIFORNIA

BERKELEY, CALIF.—Steel Tank & Pipe Co. has bought a site at Third and Harrison streets for future plant expansion.

DOWNEY, CALIF.—Downey Tool & Die Co. has been formed by Harry D. Fidler, O. K. Follansbee and has been established at 230 Paramount boulevard.

GARDENA, CALIF.—Dow Chemical Co., has let contract to Stone & Webster, Boston, for an addition to its styrene plant at 20021 South Vermont avenue, Gardena. C. H. Rockefeller on site, is purchasing agent and C. P. Weaver is superintendent of construction. Addition is estimated to cost about $1,797,000 and will produce ethyl-benzine for 100 octane gasoline and synthetic rubber.

GLENDALE, CALIF.—Miller Machine Co., has obtained a building permit for a factory building at 3612 San Fernando road, to cost about $5500.

LOS ANGELES—Kyle Steel Construction Co. is building a craneway costing about $2400 at its plant, 5200 Alcoa avenue, Vernon district.

LOS ANGELES—Thermador Electric Mfg. Co., 5119 South Riverside drive, Bell Garden district, has a building permit for a plant addition costing about $19,500 and for plant alterations costing $2000.

LOS ANGELES—B. & W. Machine Shop Inc. has been incorporated with 1000 shares of no par value stock by Randell C. Woods and Carl A. Beaudry, of Bell, Calif., and Charles B. Taylor, 735 Van Nuys building, Los Angeles, the latter being agent for the corporation.

OAKLAND, CALIF.—Ludlow Steel Products Co. has bought a 2½-acre site for a new steel products manufacturing plant.

OAKLAND, CALIF.—Parity Ltd. has leased property at 340 Twenty-ninth avenue for a new plant to process pipe, tanks and containers with plastic coatings.

OAKLAND, CALIF.—Charles S. Hughes Co. has bought a nine-acre site for a building materials plant.

PASADENA, CALIF.—Chicago Engineering Co., 97 West Union street, is building a storage building at cost of about $4000.

PASADENA, CALIF.—Fletcher Aviation Co., 309 South Raymond avenue, has obtained building permit for a plant addition to cost about $7900.

OREGON

ASTORIA, OREG.—Bioproducts Oregon Ltd. has received priorities for a cold storage warehouse and $50,000 plant to extract vitamins, chemicals and fish oil for tanning. Building will be of concrete.

PORTLAND, OREG.—American Steel Warehouse Co., 920 Northeast Glisan street, has received WPB authorization for construction of a steel warehouse. Company, headed by Hugh Hedinger, was incorporated recently. Contract for first unit has been let to A. R. Bingham. Plans are by Earl Cash.

TILLAMOOK, OREG.—City, City Hall, is having plans prepared for a sewage treatment plant and interceptor sewer to cost $55,000. FWA assistance has been asked. U. E. Nelson, Railway Exchange building, Portland, Oreg., is engineer.

WASHINGTON

WALLA WALLA, WASH.—Continental Can Co., Thirteenth and Dell streets, plans a warehouse extension at its plant, to cost about $100,000.

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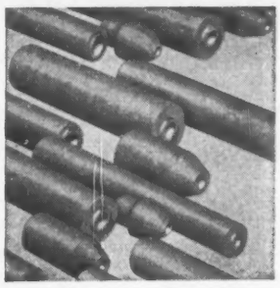

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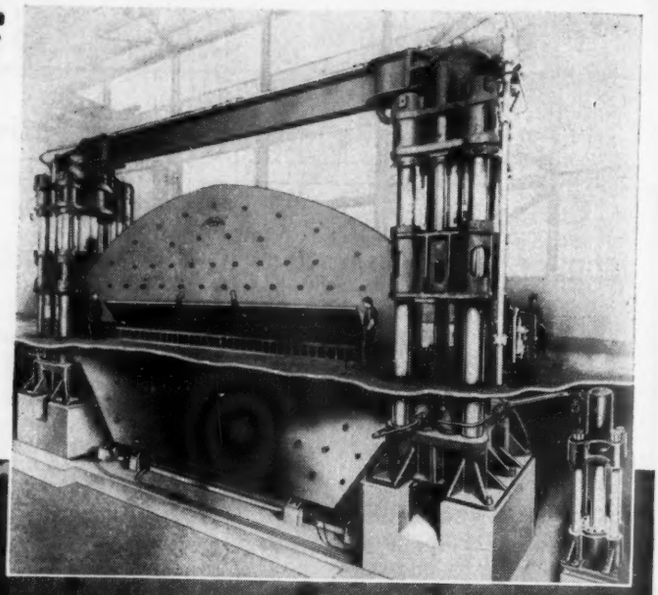

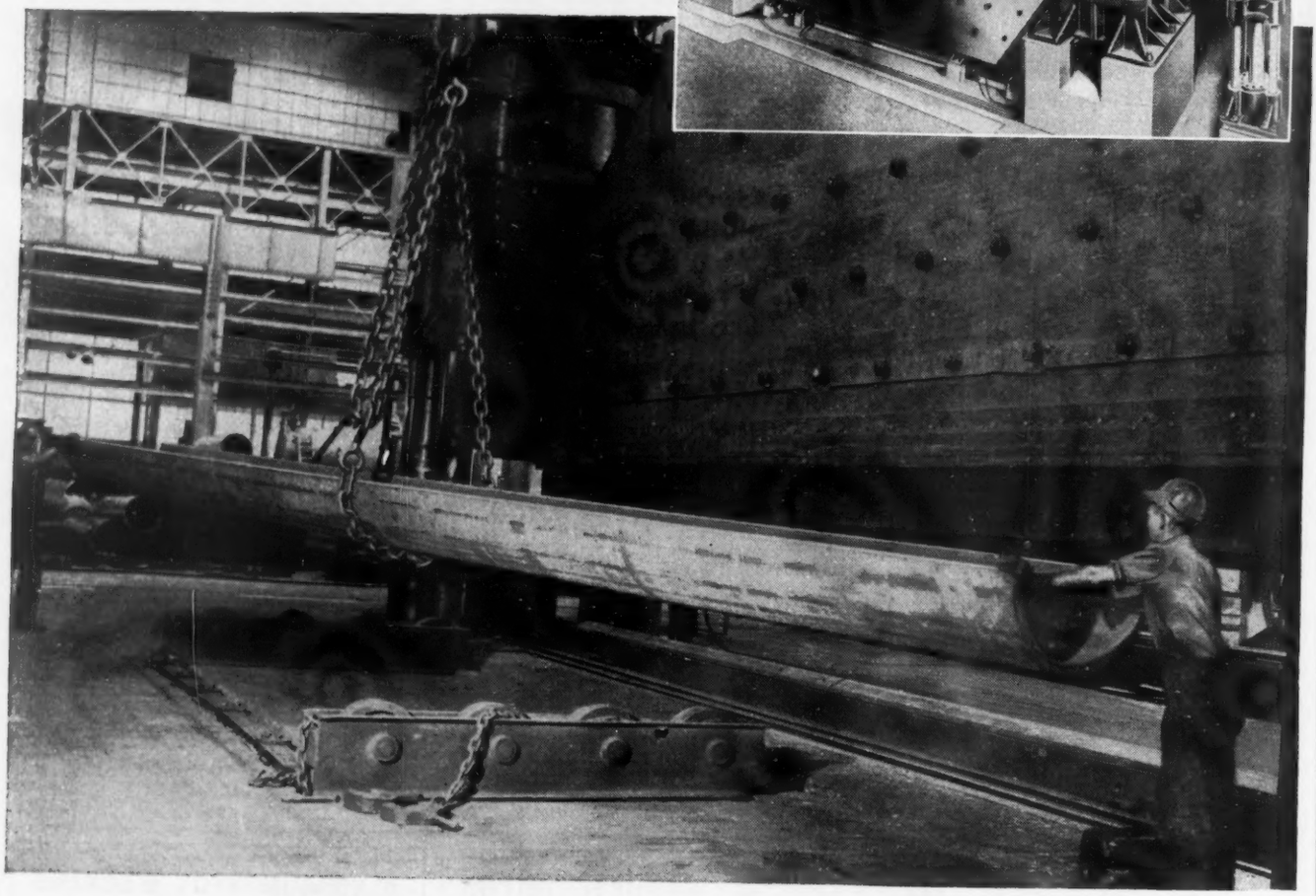

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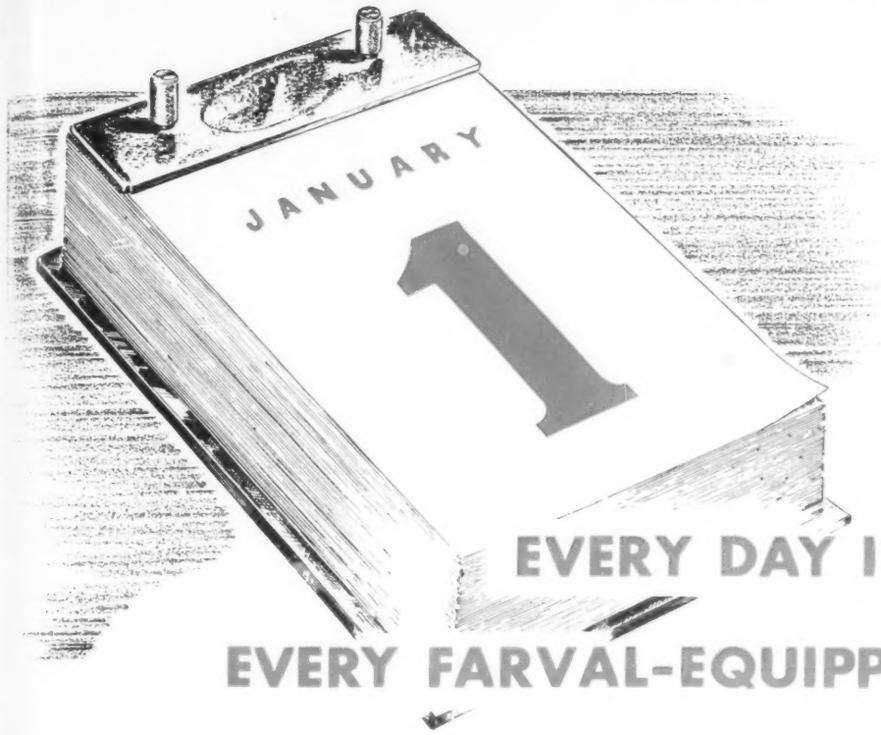

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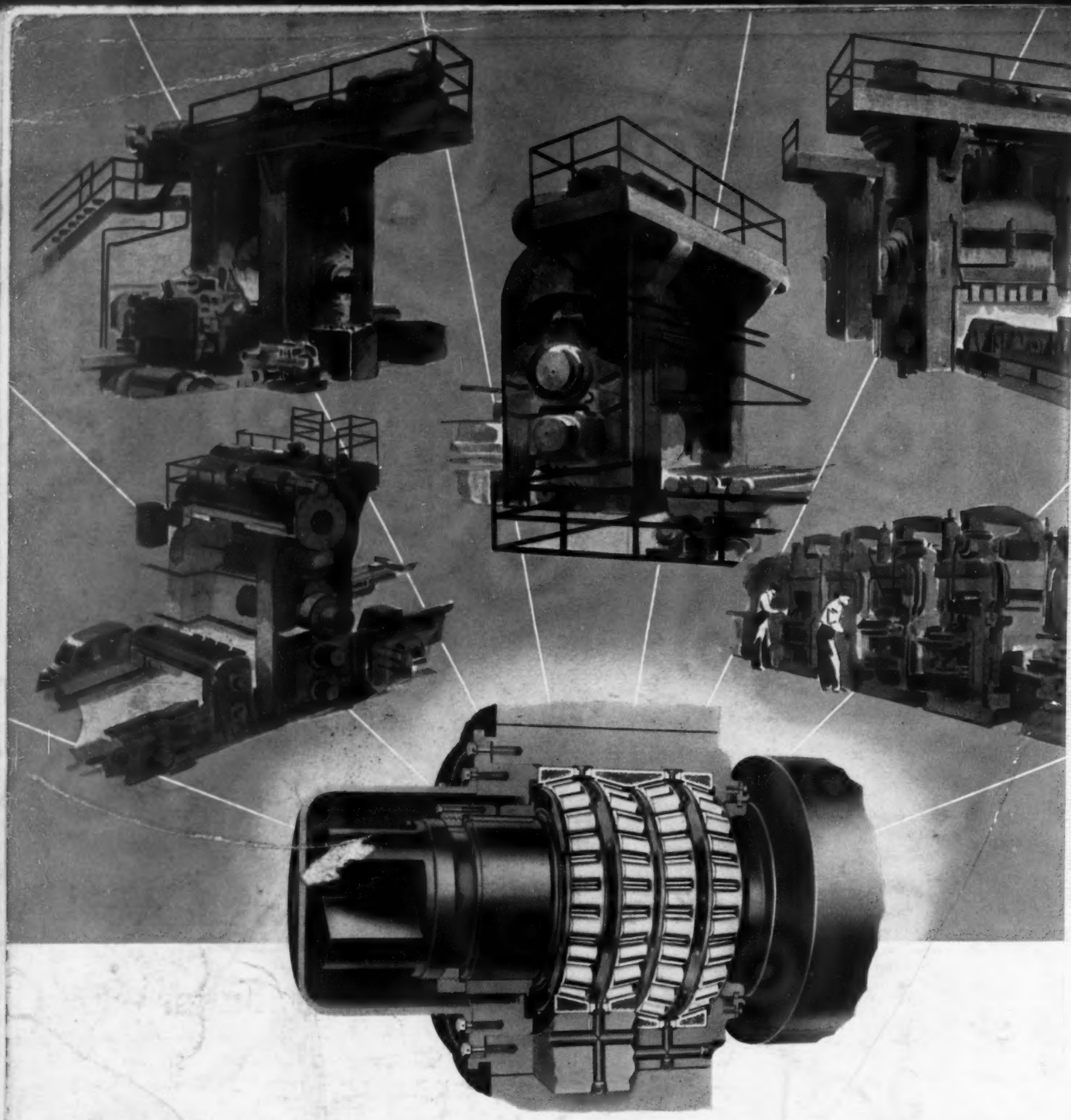

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SECTION TWO
JANUARY 1, 1945

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Abrasive Company, Tacony & Fraley Sts., Philadelphia 37, Pa.
Alloy Metal Abrasive Co., 311 W. Huron St., Ann Arbor, Mich.
American Foundry Equipment Co., 509 S. Byrkit St., Mishawaka, Ind.
Carborundum Co., The, Niagara Falls, N. Y.
General Abrasive Co., Inc., Niagara Falls, N. Y.
Pangborn Corporation, Hagerstown, Md.
Pittsburgh Crushed Steel Co., 4839 Harrison St., Pittsburgh 1, Pa.

ABRASIVES (Coated Paper & Cloth)

Abrasive Products Inc., 511 Pearl St., S. Braintree, Mass.
Carborundum Co., The, Niagara Falls, N. Y.
General Abrasive Co., Inc., Niagara Falls, N. Y.
Industrial Abrasives, Inc. 3724 W. 38th St., Dept. 3-N, Chicago 32, Ill.
Mid-West Abrasive Co., 1960 E. Milwaukee Ave., Detroit 11, Mich.
Minnesota Mining & Mfg. Co., 900 Fauquier St., St. Paul 6, Minn.
Siefen, J. J., Co., 5657 Lauderdale Ave., Detroit 9, Mich.

ABRASIVES (Grinding Wheel)

Abrasive Company, Tacony & Fraley Sts., Philadelphia 37, Pa.
General Abrasive Co., Inc., Niagara Falls, N. Y.
Mid-West Abrasive Co., 1960 E. Milwaukee Ave., Detroit 11, Mich.
Peninsular Grinding Wheel Co., 729 Meldrum Ave., Detroit 7, Mich.

ABRASIVES (Optical Grains)

Abrasive Company, Tacony & Fraley Sts., Philadelphia 37, Pa.
General Abrasive Co., Inc., Niagara Falls, N. Y.

ABRASIVES (Polishing)

Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa.
Carborundum Co., The, Niagara Falls, N. Y.
Chicago Wheel & Manufacturing Co., Dept. ST.—1101 W. Monroe St., Chicago 7, Ill.
General Abrasive Co., Inc., Niagara Falls, N. Y.
Mid-West Abrasive Co., 1960 E. Milwaukee Ave., Detroit 11, Mich.
Norton Co., Worcester 6, Mass.
Siefen, J. J., Co., 5657 Lauderdale Ave., Detroit 9, Mich.

ACCUMULATORS AND CONTROLS

Aldrich Pump Co., The, 8 Pine St., Allentown, Pa.
Babcock & Wilcox Co., The, 85 Liberty St., New York 6, N. Y.
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia 42, Pa.
Birdsboro Steel Fdry. & Machine Co., Birdsboro, Pa.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Hydropress, Inc., 570 Lexington Ave., New York 22, N. Y.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee 10, Wis.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
Morgan Engineering Co., The, Alliance, O.
Schloemann Engineering Corp., 1105 Empire Bldg., Pittsburgh 22, Pa.
Taylor-Wilson Mfg. Co., 15 Thomson Ave., McKees Rocks, Pa.
Wood, R. D., Co., 400 Chestnut St., Philadelphia 5, Pa.

ACETYLENE

Air Reduction, 60 E. 42nd St., New York 17, N. Y.
Linde Air Products Co., The, 30 E. 42nd St., New York 17, N. Y.

ACID-PROOF LININGS

Ceilcote Co., 750 Rockefeller Bldg., Cleveland 13, O.
Goodrich, B. F., Co., The, Akron, O.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.
Heil Engineering Co., 12903 Elmwood Ave., Cleveland 11, O.
National Carbon Co., Inc., 30 E. 42nd St., New York 17, N. Y.
National Lead Co., 111 Broadway, New York 6, N. Y.
Pennsylvania Salt Mfg. Co., 1000 Widener Bldg., Philadelphia 7, Pa.
Rheem Research Products, Inc., 2523 Pennsylvania Ave., Baltimore 17, Md.
Siefen, J. J., Co., 5657 Lauderdale Ave., Detroit 9, Mich.
United States Rubber Co., Mechanical Goods Div., 1230 Sixth Ave., New York 20, N. Y.

AEROCASING

Lakeside Steel Improvement Co., The, 5418 Lakeside Ave., Cleveland 14, O.

AGITATORS

Blaw-Knox Div. of Blaw-Knox Co., Blawnox, Pa.
Graver Tank & Mfg. Co., Inc., 4811-29 Tod Ave., E. Chicago, Ind.
Porter, H. K., Company, Inc., 49th & Harrison Sts., Pittsburgh 1, Pa.

AIR CONDITIONING EQUIPMENT

American Air Filter Co., Inc., 443 Central Ave., Louisville 8, Ky.
American Blower Corp., 8111 Tireman Ave., Detroit 4, Mich.
Buffalo Forge Co., 158 Mortimer St., Buffalo 5, N. Y.
General Electric Co. (Air Conditioning & Commercial Refrigeration Div. Sec. 4412), Bloomfield, N. J.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Salem Engineering Co., Air Conditioning and Refrigeration Div., 714 S. Broadway, Salem, O.
Schneible, Claude B., Co., 2827 25th St., Detroit 16, Mich.
Sturtevant, B. F., Co., Hyde Park, Boston 36, Mass.
Weatherhead Co., The, 300 E. 131st St., Cleveland 8, O.
Westinghouse Electric & Mfg. Co., 653 Page Blvd., Springfield 2, Mass.

AIRCRAFT ACCESSORIES, PARTS, SUPPLIES

Bardwell & McAlister, Inc., P. O. Box 1310, Hollywood 28, Cal.
Brandt, Charles T., Inc., 1702 Ridgely St., Baltimore 30, Md.
Burgess-Norton Mfg. Co., 778 Peyton St., Geneva, Ill.
Chicago Screw Co., The, 1026 S. Homan Ave., Chicago 24, Ill.
Cleveland Pneumatic Tool Co., The, 3781 E. 77th St., Cleveland 5, O.
Denison Engineering Co., The, 1163 Dublin Rd., Columbus 16, O.
Dresser Manufacturing Co., Bradford, Pa.
Elastic Stop Nut Corp., 982 Stuyvesant Ave., Union, N. J.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.
Fidelity Machine Company, 3908-18 Frankford Ave., Philadelphia 24, Pa.
Garrett, George K., Co., 1421 Chestnut St., Philadelphia 2, Pa.
General Electric Co., Sec. A-443-90 Tungar & Metallic Rectifier Div., Bridgeport, 2, Conn.
Grammes, L. F., & Sons, Inc., Allentown, Pa.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Hall, C. M., Lamp Co., 1005 E. Hancock St., E., Detroit 7, Mich.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago 50, Ill.
Lewthwaite, T. H., Machine Co., Inc., 311 E. 47th St., New York 17, N. Y.
Mullins Mfg. Co., Warren, O.
National Screw & Mfg. Co., The, 2440 E. 75th St., Cleveland 4, O.
Nichols, W. H., and Sons, Waltham 54, Mass.
Pesco Products Co., 11610 Euclid Ave., Cleveland 6, O.
Standard Products Co., The, 505 Boulevard Bldg., Detroit 2, Mich.
Steel and Tubes Div. Republic Steel Corp., 226 E. 131st St., Cleveland 8, O.
Steel Improvement & Forge Co., The, 942 E. 64th St., Cleveland 14, O.
U. S. Automatic Corp., Amherst, O.
Wagner, E. R., Mfg. Co., 4615 N. 32nd St., Milwaukee 9, Wis.
Weatherhead Co., The, 300 E. 131st St., Cleveland 8, O.

AIRLESS BLAST CLEANING EQUIPMENT

American Foundry Equipment Co., 509 S. Byrkit St., Mishawaka, Ind.
Pangborn Corporation, Hagerstown, Md.

AIRPLANES

Consolidated Vultee Aircraft Corp., 3301 Pacific Highway, San Diego, Cal.

ALLOY METALS (Nonferrous)—See METALS (Nonferrous)

ALLOY STEELS (Heat Resistant)

Bethlehem Steel Co., Bethlehem, Pa.
Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
International Nickel Co., Inc., The, 67 Wall St., New York 5, N. Y.
Michiana Products Corp., Michigan City, Ind.
Midvale Co., The, Nicetown, Philadelphia 40, Pa.
Taylor-Wharton Iron & Steel Co., Easton, Pa.

ALLOYS (Ferroalloys)—See FERROALLOYS

ALLOYS (Heat Resistant)

Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y.
Haynes Stellite Co., 30 E. 42nd St., New York 17, N. Y.
Hedstrom, Oscar W., Corp., 4824 W. Division St., Chicago 51, Ill.
International Nickel Co., The, 67 Wall St., New York 5, N. Y.

ALLOYS (Magnesium)

Bohn Aluminum & Brass Corp., Lafayette Bldg., Detroit 26, Mich.
Dow Chemical Co., The, Midland, Mich.

ALLOYS (Nonferrous)

Ajax Metal Co., Philadelphia 43, Pa.
American Brass Co., The, Waterbury 88, Conn.
Bohn Aluminum & Brass Corp., Lafayette Bldg., Detroit 26, Mich.
Bunting Brass & Bronze Co., The, 715 Spencer St., Toledo 1, O.
Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Handy & Harman, 82 Fulton St., New York 7, N. Y.
Haynes Stellite Co., 30 E. 42nd St., New York 17, N. Y.
Hedstrom, Oscar W., Corp., 4824 W. Division St., Chicago 51, Ill.
International Nickel Co., Inc., The, 67 Wall St., New York 5, N. Y.
Mallory, P. R., & Co., Inc. 3029 E. Washington St., Indianapolis 6, Ind.
Western Cartridge Co., Brass Mill Div., East Alton, Ill.

ALLOYS (Silver)

Handy & Harman, 82 Fulton St., New York 7, N. Y.

ALUMINUM (Screw Stock)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.

ALUMINUM AND ALUMINUM ALLOYS

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
Bohn Aluminum & Brass Corp., Lafayette Bldg., Detroit 26, Mich.
Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Hedstrom, Oscar W., Corp., 4824 W. Division St., Chicago 51, Ill.
Reliance Steel Corp. Div. Detroit Steel Corp., 1025 S. Oakwood Ave., Detroit 25, Mich.

ANGLES—See BEAMS, CHANNELS, ANGLES

ANNEALING (Tempering)

Lakeside Steel Improvement Co., The, 5418 Lakeside Ave., Cleveland 14, O.
Lepel High Frequency Laboratories, Inc., 39 W. 60th St., New York 23, N. Y.

ANNEALING BOXES

Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Foundry & Machine Co., E. Chicago, Ind.
General American Transportation Corp., 135 S. La Salle St., Chicago 90, Ill.
Graver Tank & Mfg. Co., Inc., 4811-29 Tod Ave., E. Chicago, Ind.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
National Annealing Box Co., Washington, Pa.
Pittsburgh Steel Foundry Corp., Glassport, Pa.
Rolock, Inc., 1380 Kings Highway, Fairfield, Conn.
Union Steel Casting Div. of Blaw-Knox Co., 62nd & Butler Sts., Pittsburgh 1, Pa.
United Engineering & Foundry Co., First National Bank Bldg., Pittsburgh 22, Pa.
Wean Engineering Co., Inc., The Warren, O.
Wilson, Lee, Engineering Co., 20005 Lake Rd., Cleveland 16, O.
Youngstown Welding & Eng. Co., The, 3711 Oakwood Ave., Youngstown 9, O.

ANNEALING COVERS

Blaw-Knox Div. of Blaw-Knox Co., Blawnox, Pa.
General American Transportation Corp., 135 S. La Salle St., Chicago 90, Ill.
National Annealing Box Co., Washington, Pa.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh 12, Pa.
Pittsburgh Steel Foundry Corp., Glassport, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Wean Engineering Co., Inc., The, Warren, O.
Youngstown Welding & Eng. Co., The, 3711 Oakwood Ave., Youngstown 9, O.

ANODES (All Types)

American Brass Co., The, Waterbury 88, Conn.
Revere Copper & Brass Inc., 230 Park Ave., New York 17, N. Y.
Siefen, J. J., Co., 5657 Lauderdale Ave., Detroit 9, Mich.
Udylite Corp., The, 1651 E. Grand Blvd., Detroit 11, Mich.

ANODES (Lead & Lead Alloy)

National Lead Co., 111 Broadway New York 6, N. Y.

ANODES (Nickel)

Seymour Manufacturing Co., The, 51 Franklin St., Seymour, Conn.
Udyiite Corp., The 1651 E. Grand Blvd., Detroit 11, Mich.

ANODES (Silver)

Handy & Harman, 82 Fulton St., New York 7, N. Y.

ANODES (Zinc)

Meaker Co., The, 1635 S. 55th Ave., Chicago 50, Ill.

ANTISEPTIC CREAM

Wahlert Products Corp., 27 Lafayette St., Brooklyn 1, N. Y.

AUTOGRAPH REGISTERS

United Autographic Register Co., 5000 S. California Ave., Chicago 32, Ill.

AUTOMOTIVE ACCESSORIES, PARTS, SUPPLIES

Bardwell & McAlister, Inc., P. O. Box 1310, Hollywood 28, Cal.
Burgess-Norton Mfg. Co., 778 Peyton St., Geneva, Ill.
Chicago Screw Co., The, 1026 S. Homan Ave., Chicago 24, Ill.
Cleveland Pneumatic Tool Co., The, 3781 E. 77th St., Cleveland 5, O.
Elastic Stop Nut Corp., 982 Stuyvesant Ave., Union, N. J.
General Electric Co., Sec. A-443-90, Tungar & Metallic Rectifier Div., Bridgeport 2, Conn.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago 50, Ill.
Lewthwaite, T. H., Machine Co., Inc., 311 E. 47th St., New York 17, N. Y.
Pesco Products Co., 11610 Euclid Ave., Cleveland 6, O.

AUTOMOTIVE ACCESSORIES, PARTS, SUPPLIES (Con.)

Standard Products Co., The, 505 Boulevard Bldg., Detroit 2, Mich.
Steel Improvement & Forge Co., The, 942 E. 64th St., Cleveland 14, O.
U. S. Automatic Corp., Amherst, O.
Weatherhead Co., The, 300 E. 131st St., Cleveland 8, O.

AXLES

Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia 42, Pa.

BABBITT METAL

Ajax Metal Co., Philadelphia 43, Pa.
Bohn Aluminum & Brass Corp., Lafayette Bldg., Detroit 26, Mich.
Cadman, A. W., Mfg. Co., 28th & Smallman Sts., Pittsburgh 22, Pa.
National Bearing Metals Corp., 4930 Manchester Ave., St. Louis 10, Mo.
National Lead Co., 111 Broadway, New York 6, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.

BABBITT RETAINER

Products Manufacturing Co., 513 E. Buffalo St., Milwaukee 2, Wis.

BALANCING MACHINES

Gisholt Machine Co., 1217 E. Washington Ave., Madison 3, Wis.
Snyder Tool & Engineering Co., 3400 E. Lafayette Ave., Detroit 7, Mich.

BALING PRESSES

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia 42, Pa.
Galland-Henning Manufacturing Co., 2747 S. 31st St., Milwaukee 7, Wis.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee 10, Wis.

BALL JOINTS (Automotive and Aircraft)

Chicago Screw Co., The, 1026 S. Homan Ave., Chicago 24, Ill.
Tourek, J. J., Mfg. Co., 4701-11 W. 16th St., Chicago 50, Ill.

BALLS (Brass or Bronze)

Atlas Ball Div., SKF Industries, Inc., Philadelphia 34, Pa.
Hoover Ball & Bearing Co., Ann Arbor, Mich.
Strom Steel Ball Co., 1850 S. 54th Ave., Cicero, Ill.

BALLS (Grinding)

Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Taylor-Wharton Iron & Steel Co., Easton, Pa.

BALLS (Special Alloy Metals)

Atlas Ball Div., SKF Industries, Inc., Philadelphia 34, Pa.

BALLS (Steel) (*Also Stainless)

*Atlas Ball Div. SKF Industries, Inc., Philadelphia 34, Pa.
Hoover Ball & Bearing Co., Ann Arbor, Mich.
*Strom Steel Ball Co., 1850 S. 54th Ave., Cicero, Ill.

BANDS AND HOOPS (Iron and Steel)

American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
American Welding & Mfg. Co., The, Warren, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Dresser Manufacturing Co., Bradford, Pa.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
Levinson Steel Sales Co., The, 33 Pride St., Pittsburgh 19, Pa.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Stanley Works, The, New Britain & Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham 2, Ala.
United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.
Wisconsin Steel Co., 180 N. Michigan Ave., Chicago 1, Ill.

BAR MACHINING EQUIPMENT

Pines Engineering Co., 600 Prairie St., Aurora, Ill.

BARGE MOVERS

Silent Hoist & Crane Co., 849 63rd St., Brooklyn 20, N. Y.

BARGES (Steel)

American Bridge Co., Frick Bldg., Pittsburgh 19, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Dravo Corp. (Engin'r'g Works Div.) Neville Island, Pittsburgh 25, Pa.
Federal Shipbuilding & Dry Dock Co., Kearny, N. J.
Ingalls Iron Works Co., The, Birmingham 2, Ala.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.

BARGES (Wood)

Koppers Co., Wood Preserving Div., 500 Koppers Bldg., Pittsburgh 19, Pa.

BARRELS (Plating)

Siefen, J. J., Co., 5657 Lauderdale Ave., Detroit 9, Mich.
Udylite Corp., The, 1651 E. Grand Blvd., Detroit 11, Mich.

BARRELS (Rubber Lined)

Goodrich, B. F., Co., The, Akron, O.
United States Rubber Co., Mechanical Goods Div., 1230 Sixth Ave., New York 20, N. Y.

BARRELS (Steel)

Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y.
Rheem Research Products, Inc., 2523 Pennsylvania Ave., Baltimore 17, Md.

BARRELS (Tumbling)

Ransohoff, N., Inc., 1317 Township Ave., Cincinnati 16, O.

BARS (Alloy Steel)

Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Ampco Metal Inc., Dept. S-11, Milwaukee 4, Wis.
Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss & Laughlin, Inc., Harvey, Ill.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
Columbia Steel Co., San Francisco 6, Calif.
Copperweld Steel Co., Warren, O.
Craine-Schrage Steel Co., 1025 S. Oakwood Ave., Detroit 25, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Follansbee Steel Corp., Third & Liberty Sts., Pittsburgh 30, Pa.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York 13, N. Y.
Great Lakes Steel Corp., Ecorse, Detroit 18, Mich.
International Nickel Co. Inc., The, 67 Wall St., New York 5, N. Y.
Jessop Steel Co., 584 Green St., Washington, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Levinson Steel Sales Co., The, 33 Pride St., Pittsburgh 19, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis 7, Ind.
Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh 30, Pa.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton 6, O.
United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.
Wisconsin Steel Co., 180 N. Michigan Ave., Chicago 1, Ill.
Wyckoff Steel Co., P. O. Box 1256, Pittsburgh 30, Pa.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

BARS (Aluminum or Magnesium)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
Bohn Aluminum & Brass Corp., Lafayette Bldg., Detroit 26, Mich.
Dow Chemical Co., The, Midland, Mich.

BARS (Brass, Bronze or Copper)

American Brass Co., The, Waterbury 88, Conn.
Bohn Aluminum & Brass Corp., Lafayette Bldg., Detroit 26, Mich.
Bridgeport Brass Co., Bridgeport 2, Conn.
Bunting Brass & Bronze Co., The, 715 Spencer St., Toledo 1, O.
Copperweld Steel Co., Warren, O.
Johnson Bronze Co., 550 S. Mill St., New Castle, Pa.
National Bearing Metals Corp., 4930 Manchester Ave., St. Louis 10, Mo.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Shenango-Penn Mold Co., 444 W. Third St., Dover, O.
Western Cartridge Co., Brass Mill Div., East Alton, Ill.

BARS (Cold Finished)—See STEEL (Cold Finished)

BARS (Concrete Reinforcing)

Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco 6, Calif.
Foster, L. B., Co., Inc., P. O. Box 1647, Pittsburgh, Pa.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Levinson Steel Sales Co., The, 33 Pride St., Pittsburgh 19, Pa.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham 2, Ala.
United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.
Wisconsin Steel Co., 180 N. Michigan Ave., Chicago 1, Ill.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

BARS (Iron)

Ryerson, Jos. T., & Sons, Inc., 16th & Rockwell Sts., Chicago 80, Ill.

BARS (Steel) (*Also Stainless)

*Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
American Petrometal Corp., 1102 Broadway at 11th St., Long Island City 2, N. Y.
*American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Benedict-Miller, Inc., 216 Clifford St., Newark 5, N. J.
*Bethlehem Steel Co., Bethlehem, Pa.
*Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
*Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
*Columbia Steel Co., San Francisco 6, Calif.
Continental Steel Corp., Kokomo, Ind.
*Copperweld Steel Co., Warren, O.
Craine-Schrage Steel Co., 1025 S. Oakwood Ave., Detroit 25, Mich.
Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y.
Enterprise Galvanizing Co., 3525 E. Cumberland St., Philadelphia 25, Pa.
*Firth-Sterling Steel Co., McKeesport, Pa.
*Frasse, Peter A., & Co., Inc., 17 Grand St., New York 13, N. Y.
Great Lakes Steel Corp., Ecorse, Detroit 18, Mich.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
*Jessop Steel Co., 584 Green St., Washington, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Levinson Steel Sales Co., The, 33 Pride St., Pittsburgh 19, Pa.
*Midvale Co., The, Nicetown, Philadelphia 40, Pa.
*Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh 30, Pa.
Purdy, A. R., Co., 790 Greenwich St., New York 14, N. Y.
*Republic Steel Corp., Dept. ST, Cleveland 4, O.
*Rustless Iron & Steel Corp., 3400 E. Chase St., Baltimore 13, Md.
*Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Stanley Works, The, New Britain & Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham 2, Ala.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton 6, O.
*United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.
Weirton Steel Co., Weirton, W. Va.
Wisconsin Steel Co., 180 N. Michigan Ave., Chicago 1, Ill.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

BASES—(Welded Steel)

American Welding & Mfg. Co., The, Warren, O.
Bethlehem Steel Co., Bethlehem, Pa.
Brandt, Charles T., Inc., 1702 Ridgely St., Baltimore 30, Md.
Danly Machine Specialties, Inc., 2100 S. 52nd Ave., Chicago 50, Ill.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Graver Tank & Mfg. Co., Inc., 4811-29 Tod Ave., E. Chicago, Ind.
Mahon, R. C., Co., The, 8650 Mt. Elliott Ave., Detroit 11, Mich.
Mississippi Valley Structural Steel Co., Decatur, Ill.
Youngstown Welding & Eng. Co., The, 3711 Oakwood Ave., Youngstown 9, O.

BASKETS (Perforated Metal)

Diamond Mfg. Co., Wyoming, Pa.

BASKETS (Wire and Metal)

Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Wire Works Co., Inc., 437 Terrace Rd., Buffalo 2, N. Y.
Rolock, Inc., 1350 Kings Highway, Fairfield, Conn.
Siefen, J. J., Co., 5657 Lauderdale Ave., Detroit 9, Mich.

BATHS (Heat Treating, Cyanide, Salt)

Holden, A. F., Co., The, P. O. Box 1898, New Haven 8, Conn.
Tate-Jones & Co., Inc., Leetsdale, Pa.

BATTERIES (Industrial Truck)

Philco Corp., Storage Battery Div., 467 Calhoun St., Trenton 7, N. J.

BATTERIES (Storage)

Edison Storage Battery Div. of Thomas A. Edison, Inc., West Orange, N. J.
Electric Storage Battery Co., The, 19th St. and Allegheny Ave., Philadelphia 32, Pa.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Philco Corp., Storage Battery Div., 467 Calhoun St., Trenton 7, N. J.

BATTERY CHARGING APPARATUS

Clark Controller Co., The, 1146 E. 152nd St., Cleveland 10, O.
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee 1, Wis.
Fairbanks, Morse & Co., Fairbanks-Morse Bldg., Chicago 5, Ill.
Federal Telephone & Radio Corp., Div. International Telephone & Telegraph Corp., 32 Central Ave., Newark 1, N. J.
General Electric Co., Schenectady 5, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.
Ward Leonard Electric Co., 65 South St., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

BEAMS, CHANNELS, ANGLES ETC. (Aluminum or Magnesium)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
Dow Chemical Co., The, Midland, Mich.

BEAMS, CHANNELS, ANGLES, ETC. (Steel) (*Also Stainless)

*Bethlehem Steel Co., Bethlehem, Pa.
*Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
*Columbia Steel Co., San Francisco 6, Calif.
*Enterprise Galvanizing Co., 3525 E. Cumberland St., Philadelphia 25, Pa.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
International Nickel Co., Inc., The, 67 Wall St., New York 5, N. Y.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Levinson Steel Sales Co., The, 33 Pride St., Pittsburgh 19, Pa.
*Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham 2, Ala.
*United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.
Weirton Steel Co., Weirton, W. Va.
Wisconsin Steel Co., 180 N. Michigan Ave., Chicago 1, Ill.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

BEARINGS (Aluminum, Brass or Bronze)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
Ampco Metal Inc., Dept. S-11, Milwaukee 4, Wis.
Bohn Aluminum & Brass Corp., Lafayette Bldg., Detroit 26, Mich.
Bunting Brass & Bronze Co., The, 715 Spencer St., Toledo 1, O.
Cadman, A. W., Mfg. Co., 28th & Smallman Sts., Pittsburgh 22, Pa.
Johnson Bronze Co., 550 S. Mill St., New Castle, Pa.
Moraine Products Div., General Motors Corp., Dayton 1, O.
National Bearing Metals Corp., 4930 Manchester Ave., St. Louis 10, Mo.
Shenango-Penn Mold Co., 444 W. Third St., Dover, O.

BEARINGS (Babbitt)

Bunting Brass & Bronze Co., The, 715 Spencer St., Toledo 1, O.
Johnson Bronze Co., 550 S. Mill St., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.
Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.
Medart Co., The, 3500 DeKalb St., St. Louis 18, Mo.
Moraine Products Div., General Motors Corp., Dayton 1, O.
National Bearing Metals Corp., 4930 Manchester Ave., St. Louis 10, Mo.
National Lead Co., 111 Broadway New York 6, N. Y.

BEARINGS (Ball)

Bantam Bearings Div., The Torrington Co., South Bend 21, Ind.
Bearings Co. of America, Lancaster, Pa.
Burgess-Norton Mfg. Co., 778 Peyton St., Geneva, Ill.
Dodge Manufacturing Corp., Mishawaka, Ind.
Fafnir Bearing Co., New Britain, Conn.
Hoover Ball & Bearing Co., Ann Arbor, Mich.
Kaydon Engineering Corp., The, McCracken St., Muskegon, Mich
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
New Departure, Div. of General Motors Corp., Bristol, Conn.
Norma-Hoffman Bearings Corp., Stamford, Conn.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia 34, Pa.
Torrington Co., The, Torrington, Conn.

BEARINGS (Graphite)

National Carbon Co., Inc., 30 E. 42nd St., New York 17, N. Y.

BEARINGS (Journal)

Bantam Bearings Div., The Torrington Co., South Bend 21, Ind.
Dodge Manufacturing Corp., Mishawaka, Ind.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Division, General Motors Corp., Harrison, N. J.
Kaydon Engineering Corp., The, McCracken St., Muskegon, Mich.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.
Medart Co., The, 3500 DeKalb St., St. Louis 18, Mo.
National Bearing Metals Corp., 4930 Manchester Ave., St. Louis 10, Mo.
National Lead Co., 111 Broadway, New York 6, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Roller Bearing Co. of America, Inc., Trenton 3, N. J.
Rollway Bearing Co., Inc., 541 Seymour St., Syracuse 4, N. Y.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia 34, Pa.
Timken Roller Bearing Co., The, Canton 6, O.

BEARINGS (Needle)

Bantam Bearings Div., The Torrington Co., South Bend 21, Ind.
Roller Bearing Co. of America, Inc., Trenton 3, N. J.
Torrington Co., The, Torrington, Conn.

BEARINGS (Nonmetallic)

Goodrich, B. F., Co., The, Akron, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.

BEARINGS (Oilless)

Johnson Bronze Co., 550 S. Mill St., New Castle, Pa.
Moraine Products Div., General Motors Corp., Dayton 1, O.
Rhoades, R. W., Metaline Co., Inc., 50-17 Fifth St., Long Island City 1, N. Y.

BEARINGS (Quill)

Bantam Bearings Div., The Torrington Co., South Bend 21, Ind.

BEARINGS (Radial)

American Roller Bearing Co., 420 Melwood St., Pittsburgh 13, Pa.
Bantam Bearings Div., The Torrington Co., South Bend 21, Ind.
Bearings Co. of America, Lancaster, Pa.
Fafnir Bearing Co., New Britain, Conn.
Hoover Ball & Bearing Co., Ann Arbor, Mich.
Hyatt Bearings Division, General Motors Corp., Harrison, N. J.
Kaydon Engineering Corp., The, McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Medart Co., The 3500 DeKalb St., St. Louis 18, Mo.
New Departure, Div. of General Motors Corp., Bristol, Conn.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Roller Bearing Co. of America, Inc., Trenton 3, N. J.
Rollway Bearing Co., Inc., 541 Seymour St., Syracuse 4, N. Y.
Shafer Bearing Corp., 1418 W. Washington Blvd., Chicago 7, Ill.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia 34, Pa.
Timken Roller Bearing Co., The, Canton 6, O.

BEARINGS (Roll Neck)

American Roller Bearing Co., 416 Melwood St., Pittsburgh 13, Pa.
Bantam Bearings Div., The Torrington Co., South Bend 21, Ind.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Division, General Motors Corp., Harrison, N. J.
Kaydon Engineering Corp., The, McCracken St., Muskegon, Mich
Morgan Construction Co., Worcester 5, Mass.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Rollway Bearing Co., Inc., 541 Seymour St., Syracuse 4, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia 34, Pa.
Timken Roller Bearing Co., The, Canton 6, O.

BEARINGS (Roller)

American Roller Bearing Co., 416 Melwood St., Pittsburgh 13, Pa.
Bantam Bearings Div., The Torrington Co., South Bend 21, Ind.
Dodge Manufacturing Corp., Mishawaka, Ind.
Fafnir Bearing Co., New Britain, Conn.
Hoover Ball & Bearing Co., Ann Arbor, Mich.
Hyatt Bearings Division, General Motors Corp., Harrison, N. J.
Kaydon Engineering Corp., The, McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Medart Co., The 3500 DeKalb St., St. Louis 18, Mo.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Roller Bearing Co. of America, Inc., Trenton 3, N. J.
Rollway Bearing Co., Inc., 541 Seymour St., Syracuse 4, N. Y.
Shafer Bearing Corp., 1418 W. Washington Blvd., Chicago 7, Ill.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia 34, Pa.
Timken Roller Bearing Co., The, Canton 6, O.

BEARINGS (Roller Tapered)

Bantam Bearings Div., The Torrington Co., South Bend 21, Ind.
Dodge Manufacturing Corp., Mishawaka, Ind.
Hoover Ball & Bearing Co., Ann Arbor, Mich.
Kaydon Engineering Corp., The, McCracken St., Muskegon, Mich.
Medart Co., The 3500 DeKalb St., St. Louis 18, Mo.
Timken Roller Bearing Co., The, Canton 6, O.

BEARINGS (Rolling Mill)

American Roller Bearing Co., 416 Melwood St., Pittsburgh 13, Pa.
Bantam Bearings Div., The Torrington Co., South Bend 21, Ind.
Hyatt Bearings Div., General Motors Corp., Harrison, N. J.
Kaydon Engineering Corp., The, McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Morgan Construction Co., Worcester 5, Mass.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Roller Bearing Co. of America, Inc., Trenton 3, N. J.
Shafer Bearing Corp., 1418 W. Washington Blvd., Chicago 7, Ill.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia 34, Pa.
Timken Roller Bearing Co., The, Canton 6, O.

BEARINGS (Sealed)

Bearings Co. of America, Lancaster, Pa.
Hoover Ball & Bearing Co., Ann Arbor, Mich.
New Departure, Division of General Motors, Bristol, Conn.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Shafer Bearing Corp., 1418 W. Washington Blvd., Chicago 7, Ill.

BEARINGS (Silver)

Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.

BEARINGS (Shaft Hanger)

Dodge Manufacturing Corp., Mishawaka, Ind.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Medart Co., The 3500 DeKalb St., St. Louis 18, Mo.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Shafer Bearing Corp., 1418 W. Washington Blvd., Chicago 7, Ill.

BEARINGS (Thrust)

American Roller Bearing Co., 416 Melwood St., Pittsburgh 13, Pa.
Bantam Bearings Div., The Torrington Co., South Bend 21, Ind.
Bearings Co. of America, Lancaster, Pa.
Fafnir Bearing Co., New Britain, Conn.
Hoover Ball & Bearing Co., Ann Arbor, Mich.
Kaydon Engineering Corp., The, McCracken St., Muskegon, Mich.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Rollway Bearing Co., Inc., 541 Seymour St., Syracuse 4, N. Y.
Shafer Bearing Corp., 1418 W. Washington Blvd., Chicago 7, Ill.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia 34, Pa.
Timken Roller Bearing Co., The, Canton 6, O.

BELL HOISTS

Otis Elevator Co., 260 11th Ave., New York 1, N. Y.

BELTING (Conveyor)

Boston Woven Hose & Rubber Co., P.O. Box 1071, Boston 3, Mass.
Goodrich, B. F., Co., The, Akron, O.
United States Rubber Co., Mechanical Goods Div., 1230 Sixth Ave., New York 20, N. Y.

BELTING (Flat Transmission)

Boston Woven Hose & Rubber Co., P.O. Box 1071, Boston 3, Mass.
Goodrich, B. F., Co., The, Akron, O.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Manheim Mfg. & Belting Co., Manheim, Pa.

BELTING (V-Drive)

Gates Rubber Co., The, 999 S. Broadway, Denver 17, Colo.
Goodrich, B. F., Co., The, Akron, O.
Manheim Mfg. & Belting Co., Manheim, Pa.

BENDING AND STRAIGHTENING MACHINES

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown 1, O.
Alliance Machine Co., The, Alliance, O.
American Broach & Machine Co., Ann Arbor, Mich.
American Foundry Equipment Co., 509 S. Byrkit St., Mishawaka, Ind.
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia 42, Pa.
Beatty Machine & Mfg. Co., Hammond, Ind.
Birdsboro Steel Fdry. & Machine Co., Birdsboro, Pa.
Buffalo Forge Co., 158 Mortimer St., Buffalo 5, N. Y.
Cleveland Crane & Engineering Co., The, Steelweld Machinery Div., The, 1125 E. 283rd St., Wickliffe, O.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland 14, O.
Consolidated Machine Tool Corp., 565 Blossom Road, Rochester 10, N. Y.
Denison Engineering Co., The, 1163 Dublin Rd., Columbus 16, O.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago 24, Ill.
Hydraulic Press Mfg. Co., The, Mt. Gilead, O.
Hydropress, Inc., 570 Lexington Ave., New York 22, N. Y.
Kardong Bros., Inc., 346 Buchanan St., Minneapolis 13, Minn.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh 30, Pa.
Lewis Machine Co., 3450 E. 76th St., Cleveland 4, O.
Lewthwaite, T. H., Machine Co., Inc., 311 E. 47th St., New York 17, N. Y.
Littell, F. J., Machine Co., 4165 N. Ravenswood Ave., Chicago 13, Ill.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee 10, Wis.
Medart Co., The 3500 DeKalb St., St. Louis 18, Mo.
Morgan Engineering Co., The, Alliance, O.
O'Neil-Irwin Mfg. Co., 304 8th Ave. S., Minneapolis 15, Minn.
Pines Engineering Co., 600 Prairie St., Aurora, Ill.
Taylor-Wilson Mfg. Co., 15 Thomson Ave., McKees Rocks, Pa.
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh 23, Pa.
Wallace Supplies Mfg. Co., 1306 Diversey Parkway, Chicago 14, Ill.
Wean Engineering Co., Inc., The, Warren, O.
Webb Corp., The, Webb City, Mo.
Yoder Co., The, 5500 Walworth Ave., Cleveland 2, O.

BENZOL AND TOLUOL RECOVERY PLANTS

Koppers Co., Engineering and Construction Div., 300 Koppers Bldg., Pittsburgh 19, Pa.

BILLETS (Forging)

Alan Wood Steel Co., Conshohocken, Pa.
Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
Copperweld Steel Co., Warren, O.
Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y.
Follansbee Steel Corp., Third & Liberty Sts., Pittsburgh 30, Pa.
Harrisburg Steel Corp., Harrisburg, Pa.
Heppenstall Co., Dept. TP, 4620 Hatfield St., Pittsburgh 1, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Midvale Co., The, Nicetown, Philadelphia 40, Pa.
Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh 30, Pa.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia 42, Pa.
Stanley Works, The, New Britain & Bridgeport, Conn.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton 6, O.
United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.
Wisconsin Steel Co., 180 N. Michigan Ave., Chicago 1, Ill.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

BILLETS AND BLOOMS (Alloy & Carbon Steel) (*Also Stainless)

*Alan Wood Steel Co., Conshohocken, Pa.
*Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
*Copperweld Steel Co., Warren, O.
Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y.
Firth-Sterling Steel Co., McKeesport, Pa.
*Follansbee Steel Corp., Third & Liberty Sts., Pittsburgh 30, Pa.
Great Lakes Steel Corp., Ecorse, Detroit 18, Mich.
Harrisburg Steel Corp., Harrisburg, Pa.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
*Jessop Steel Co., 584 Green St., Washington, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Keystone Steel & Wire Co., Peoria 7, Ill.
*Midvale Co., The, Nicetown, Philadelphia 40, Pa.
*Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh 30, Pa.
*Republic Steel Corp., Dept. ST, Cleveland 4, O.
Roebling's, John A., Sons Co., Trenton, N. J.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia 42, Pa.
Stanley Works, The, New Britain & Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham 2, Ala.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton 6, O.
Washburn Wire Co., Phillipsdale, R. I.
Wisconsin Steel Co., 180 N. Michigan Ave., Chicago 1, Ill.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

BILLETS—ALUMINUM (Forging)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.

BIMETALS

Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.

BLAST FURNACE AIR CONDITIONING

American Blower Corp., 8111 Tireman Ave., Detroit 4, Mich.
Koppers Co., Engineering & Construction Div., 300 Koppers Bldg., Pittsburgh 19, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Surface Combustion Div. of General Properties Co., Inc., 2375 Dorr St., Toledo 1, O.

BLAST FURNACE CLEANING (Gas)

McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland 1, O.

BLAST FURNACE HOISTS

Otis Elevator Co., 260 11th Ave., New York 1, N. Y.

BLAST FURNACE SPECIALTIES

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh 22, Pa.
Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland 1, O.
Pittsburgh Steel Foundry Corp., Glassport, Pa.

BLAST FURNACE STOCK HOUSES

McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland 1, O.

BLAST FURNACE STOVES

Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh 22, Pa.
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland 1, O.

BLAST FURNACES

McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland 1, O

BLOCKS (Chain)

Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Reading Chain & Block Corp., 2102 Adams St., Reading, Pa.

BLOW PIPE SYSTEMS

Mahon, R. C., Co., The, 8650 Mt. Elliott Ave., Detroit 11, Mich.

BLOW PIPES (Oxy-Acetylene)

Linde Air Products Co., The, 30 E. 42nd St., New York 17, N. Y.
Victor Equipment Co., 844-54 Folsom St., San Francisco 7, Cal.

BLOWERS

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Buffalo Forge Co., 158 Mortimer St., Buffalo 5, N. Y.
General Blower Co., 404 N. Peoria St., Chicago 22, Ill.
General Electric Co., Schenectady 5, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Sturtevant, B. F., Co., Hyde Park, Boston 36, Mass.

BLUE PRINTING MACHINES AND ACCESSORIES

Wickes Brothers, Saginaw, Mich.

BODIES (Truck-Detachable)

Dempster Brothers, Inc., 294 Shea Rd., Knoxville 17, Tenn.

BOILER HEADS

Bethlehem Steel Co., Bethlehem, Pa.

BOILERS (Water Tube)

Babcock & Wilcox Co., The, 85 Liberty St., New York 6, N. Y.
Consolidated Steel Corp., Ltd., 5700 S. Eastern Ave., Los Angeles 22, Cal.

BOILER TUBES—See TUBES (Boiler)

BOLT AND NUT MACHINERY

Denison Engineering Co., The, 1163 Dublin Rd., Columbus 16, O.
Landis Machine Co., Waynesboro, Pa.
Murchey Machine & Tool Co., 951 Porter St., Detroit 26, Mich.
National Machinery Co., The, Tiffin, O.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland 3, O.
Pawtucket Mfg. Co., 327 Pine St., Pawtucket, R. I.

BOLTS (*Also Stainless)

Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Chicago Screw Co., The, 1026 S. Homan Ave., Chicago 24, Ill.
Cleveland Cap Screw Co., 2935 E. 79th St., Cleveland 4, O.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.
*Harper, H. M., Co., The, 2646 Fletcher St., Chicago 18, Ill.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland 2, O.
*National Screw & Mfg. Co., the, 2440 E. 75th St., Cleveland 4, O.
*Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh 3, Pa.
Pawtucket Mfg. Co., 327 Pine St., Pawtucket, R. I.
*Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland 13, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
*Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
*Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.

BOLTS (Carriage and Machine)

Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Bolt Co., 101 East Ave., N. Tonawanda, N. Y.
Cleveland Cap Screw Co., 2935 E. 79th St., Cleveland 4, O.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland 2, O.
National Screw & Mfg. Co., The, 2440 E. 75th St., Cleveland 4, O.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh 3, Pa.
Pawtucket Mfg. Co., 327 Pine St., Pawtucket, R. I.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland 13, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.
Triplex Screw Co., 5341 Grant Ave., Cleveland 5, O.

BOLTS (Connecting Rod)

Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Bolt Co., 101 East Ave., N. Tonawanda, N. Y.
Chicago Screw Co., The, 1026 S. Homan Ave., Chicago 24, Ill.
Ferry Cap & Set Screw Co., 2151 Scranton Rd., Cleveland 13, O.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland 2, O.
National Screw & Mfg. Co., The, 2440 E. 75th St., Cleveland 4, O.
U. S. Automatic Corp., Amherst, O.

BOLTS (Nonferrous)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
Chicago Screw Co., The, 1026 S. Homan Ave., Chicago 24, Ill.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.
Harper, H. M., Co., The, 2646 Fletcher St., Chicago 18, Ill.
National Screw & Mfg. Co., The, 2440 E. 75 St., Cleveland 4, O.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh 3, Pa.
Pawtucket Mfg. Co., 327 Pine St., Pawtucket, R. I.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.
U. S. Automatic Corp., Amherst, O.

BOLTS (Shackle)

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Screw Co., The, 1026 S. Homan Ave., Chicago 24, Ill.
Cleveland Cap Screw Co., 2935 E. 79th St., Cleveland 4, O.
Ferry Cap & Set Screw Co., 2151 Scranton Rd., Cleveland 13, O.
Russell, Burdsall, & Ward Bolt & Nut Co., Port Chester, N. Y.
Triplex Screw Co., 5341 Grant Ave., Cleveland 5, O.
U. S. Automatic Corp., Amherst, O.

BOLTS (Special)

Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Bolt Co., 101 East Ave., N. Tonawanda, N. Y.
Cleveland Cap Screw Co., 2935 E. 79th St., Cleveland 4, O.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.
Ferry Cap & Set Screw Co., 2151 Scranton Rd., Cleveland 13, O.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland 2, O.
National Screw & Mfg. Co., The, 2440 E. 75th St., Cleveland 4, O.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh 3, Pa.
Pawtucket Mfg. Co., 327 Pine St., Pawtucket, R. I.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland 13, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
U. S. Automatic Corp., Amherst, O.

BOLTS (Spring)

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Screw Co., The, 1026 S. Homan Ave., Chicago 24, Ill.
Cleveland Cap Screw Co., 2935 E. 79th St., Cleveland 4, O.
Ferry Cap & Set Screw Co., 2151 Scranton Rd., Cleveland 13, O.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland 2, O.
Russell, Burdsall, & Ward Bolt & Nut Co., Port Chester, N. Y.
Triplex Screw Co., 5341 Grant Ave., Cleveland 5, O.
U. S. Automatic Corp., Amherst, O.

BOLTS (Stove)

American Screw Company, Providence 1, R. I.
Buffalo Bolt Co., 101 East Ave., N. Tonawanda, N. Y.
Cleveland Cap Screw Co., 2935 E. 79th St., Cleveland 4, O.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland 2, O.
National Screw & Mfg. Co., The, 2440 E. 75th St., Cleveland 4, O.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland 13, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.
Triplex Screw Co., 5341 Grant Ave., Cleveland 5, O.

BOLTS (Stove, Recessed Head)

American Screw Co., Providence 1, R. I.
Bristol Co., Waterbury 91, Conn.
Chandler Products Co., Euclid 17, O.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland 2, O.
National Screw & Mfg. Co., 2440 E. 75th St., Cleveland 4, O.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago 50, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.
U. S. Automatic Corp., Amherst, O.

BOLTS (Track)

Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Bolt Co., 101 East Ave., N. Tonawanda, N. Y.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland 2, O.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh 3, Pa.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland 13, O.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.

BORING BARS

Bokum Tool Co., 14775 Wildermere Ave., Detroit 21, Mich.
Scully-Jones & Co., 1901 S. Rockwell St., Chicago 8, Ill.

BORING BARS (Con.)

Universal Engineering Co., Frankenmuth, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, O.

BORING MILLS

Consolidated Machine Tool Corp., 565 Blossom Rd., Rochester 10, N. Y.
Cross Co., The, 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit 6, Mich.
Giddings & Lewis Machine Tool Co., 148 Doty St., Fond Du Lac, Wis.
Heald Machine Co., The, Worcester 6, Mass.
Sellers, William, & Co., Inc., 1622 Hamilton St., Philadelphia 30, Pa.

BORING MILLS (Vertical)

Bullard Co., The, Bridgeport 2, Conn.
Consolidated Machine Tool Corp., 565 Blossom Rd., Rochester 10, N. Y.

BORING TOOLS (Carbide Tipped)

Carboloy Co., Inc., 11141 E. 8 Mile Blvd., Detroit 32, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Genesee Tool Co., Fenton, Mich.
Kennametal, Inc., 200 Lloyd Ave., Latrobe, Pa.
Scully-Jones & Co., 1901 S. Rockwell St., Chicago 8, Ill.

BORING TOOLS (Diamond)

Smit, J. K., & Sons, Inc., 157 Chambers St., New York 7, N. Y.

BOXES (Open Hearth Charging)

Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Foundry & Machine Co., E. Chicago, Ind.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
Morgan Engineering Co., The, Alliance, O.
Pittsburgh Steel Foundry Corp., Glassport, Pa.
Union Steel Casting Div., Blaw-Knox Co., 62nd & Butler Sts., Pittsburgh 1, Pa.

BOXES (Stacking)

American Metal Works, Inc., 1508 Germantown Ave., Philadelphia 22, Pa.

BOXES (Wood)

Morgan Lumber Sales Co., 8 E. Long St., Columbus, O.

BRAKE DRUMS

Bethlehem Steel Co., Bethlehem, Pa.
Ladish Drop Forge Co., Cudahy, Wis.

BRAKE LININGS

Johns-Manville Corp., 22 E. 40th St., New York 16, N. Y.

BRAKES (Electric)

Clark Controller Co., The, 1146 E 152nd St., Cleveland 10, O.
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee 1, Wis.
Electric Controller & Mfg. Co., The, 2698 E. 79th St., Cleveland 4, O.
General Electric Co., Schenectady 5, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.

BRAKES (Hand)

O'Neil-Irwin Mfg. Co., 304 8th Ave. So., Minneapolis 15, Minn.

BRAZING

Burgess-Norton Mfg. Co., 778 Peyton St., Geneva, Ill.
Holden, A. F., Co., The, P. O. Box 1898, New Haven 8, Conn.
Salkover Metal Processing Co., Inc., 4209 W. Lake St., Chicago 24, Ill. 34-16 Borden Ave., Long Island City 1, N. Y.

BRAZING (Copper Hydrogen)

Burgess-Norton Mfg. Co., 778 Peyton St., Geneva, Ill.
Salkover Metal Processing Co., Inc., 4209 W. Lake St., Chicago 24, Ill. and 34-16 Borden Ave., Long Island City 1, N. Y.

BRICK (Abrasive)

Chicago Wheel & Manufacturing Co., Dept. ST, 1101 W. Monroe St., Chicago 7, Ill.
Siefen, J. J., Co., 5657 Lauderdale Ave., Detroit 9, Mich.

BRICK (Acid Resisting)

Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.
National Carbon Co., Inc., 30 E. 42nd St., New York 17, N. Y.

BRICK (Chrome)

Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.

BRICK (Fire Clay)

Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York 6, N. Y.
Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.
Remmey, Richard C., Son Co., Hedley St. & Delaware River, Philadelphia 37, Pa.

BRICK (Forsterite)

Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.

BRICK (High Alumina)

Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.

BRICK (Insulating)—See INSULATING BRICK

BRICK (Ladle)

Globe Brick Co., The, East Liverpool, O.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.

BRICK (Magnesia)

Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.

BRICK (Refractory)—See REFRACTORIES, CEMENT, ETC.

BRICK (Silica)

Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.

BRICK (Silicon Carbide)

Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., The, Perth Amboy, N. J.
Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Norton Co., Worcester 6, Mass.

BRICK (Sleeves, Nozzles, Runners, Tuyeres)

Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.
National Fireproofing Corp., 202 E. Ohio St., Pittsburgh 12, Pa.

BRIDGE CRANES (Ore and Coal Handling)—See CRANES—BRIDGE (Ore & Coal Handling)

BRIDGES, BUILDINGS, VIADUCTS, STACKS, ETC.

American Bridge Co., Frick Bldg., Pittsburgh 19, Pa.
Belmont Iron Works, 22nd St. and Washington Ave., Philadelphia 46, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
General American Transportation Corp., 135 S. La Salle St., Chicago 90, Ill.
Ingalls Iron Works Co., The, Birmingham 2, Ala.
Levinson Steel Sales Co., The, 33 Pride St., Pittsburgh 19, Pa.
Mahon, R. C., Co., The, 8650 Mt. Elliott Ave., Detroit 11, Mich.
Mississippi Valley Structural Steel Co., Melrose Park, Ill.
Stran Steel Div., Great Lakes Steel Corp., 607 Shelby Ave., Detroit, Mich.

BRIQUETTING MACHINES

Vulcan Iron Works, Wilkes-Barre, Pa.

BROACHES

American Broach & Machine Co., Ann Arbor, Mich.
Bethlehem Steel Co., Bethlehem, Pa.
Colonial Broach Co., P. O. Box No. 37, Harper Sta., Detroit 7, Mich.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit 6, Mich.
Illinois Tool Works, 2501 N. Keeler Ave., Chicago 39, Ill.
Lapointe Machine Tool Co., The, 34 Tower St., Hudson, Mass.

BROACHING MACHINES

American Broach & Machine Co., Ann Arbor, Mich.
Cincinnati Milling Machine Co., Cincinnati 9, O.
Colonial Broach Co., P. O. Box No. 37, Harper Sta., Detroit 7, Mich.
Lapointe Machine Tool Co., The, 34 Tower St., Hudson, Mass.

BROACHING PRESSES (Hydraulic)

American Broach & Machine Co., Ann Arbor, Mich.

BRUSHES (Carbon)

National Carbon Co., Inc., 30 E. 42nd St., New York 17, N. Y.

BRUSHES (Industrial)

Fuller Brush Co., The, Industrial Div., 8c, 3582 Main St., Hartford 2, Conn.

BUCKETS (Clam Shell, Dragline, Grab, Single Line)

Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland 10, O.
Blaw-Knox Division of Blaw-Knox Co., Blawnox, Pa.
Cullen-Friestedt Co., 1308 S. Kilbourn Ave., Chicago 23, Ill.
Erie Steel Construction Co., Erie, Pa.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Industrial Brownhoist Corp., Bay City, Mich.
Osgood Co., The, Marion, O.
Taylor-Wharton Iron & Steel Co., Easton, Pa.
Wellman Engineering Co., The, 7016 Central Ave., Cleveland 4, O.

BUCKETS (Electric)

Erie Steel Construction Co., Erie, Pa.

BUCKETS (Elevator)

Diamond Mfg. Co., Wyoming, Pa.
Hendrick Mfg. Co., 37 Dundaff St., Carbondale, Pa.
Jeffrey Mfg. Co., The, 889-99 N. Fourth St., Columbus 16, O.

BUCKETS (Rubber)

Goodrich, B. F., Co., The, Akron, O.
United States Rubber Co., Mechanical Goods Div., 1230 Sixth Ave., New York 20, N. Y.

BUCKETS (Single Hook, Automatic Dump, Automatic Single Line)

Blaw-Knox Div. of Blaw-Knox Co., Blawnox, Pa.
Erie Steel Construction Co., Erie, Pa.
Wellman Engineering Co., The, 7016 Central Ave., Cleveland 4, O.

BUFFERS (Electric Portable)

Chicago Wheel & Manufacturing Co., Dept. ST, 1101 W. Monroe St., Chicago 7, Ill.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.

BUILDINGS (Steel)—See BRIDGES BUILDINGS, ETC.

BULLDOZERS

Beatty Machine & Mfg. Co., Hammond, Ind.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago 24, Ill.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee 10, Wis.

BURNERS (Acetylene)—See TORCHES AND BURNERS

BURNERS (Automatic)

Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore 2, Md.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Surface Combustion Div. of General Properties Co., Inc., 2375 Dorr St., Toledo 1, O.
Wilson, Lee, Engineering Co., Inc., 20005 Lake Rd., Cleveland 16, O.

BURNERS (Pulverized Coal, Oil, Gas, Combination, Sawdust)

Babcock & Wilcox Co., The, 85 Liberty St., New York 6, N. Y.
Commercial Iron Works, P. O. Box 2230, Portland 14, Oreg.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh 3, Pa.
Holden, A. F., Co., 200 Winchester Ave., New Haven 8, Conn.
Johnson Gas Appliance Co., 626 "E" Ave., N.W., Cedar Rapids, Iowa.
Maehler, Paul, Co., The, 2208 W. Lake St., Chicago 12, Ill.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Surface Combustion Div. of General Properties Co., Inc., 2375 Dorr St., Toledo 1, O.
Tate-Jones & Co., Inc., Leetsdale, Pa.
Wilson, Lee, Engineering Co., Inc., 20005 Lake Rd., Cleveland 16, O.

BURNERS (Steel)

Commercial Iron Works, P. O. Box 2230, Portland 14, Oreg.

BURNISHING, GRINDING, LAPPING OR POLISHING COMPOUNDS

Carborundum Co., The, Niagara Falls, N. Y.
Minnesota Mining & Mfg. Co., 900 Fauquier St., St. Paul 6, Minn.
Oakite Products, Inc., 34 E Thames St., New York 6, N. Y.
Siefen, J. J., Co., 5657 Lauderdale Ave., Detroit 9, Mich.
Sun Oil Co., Dept. 1, 1608 Walnut St., Philadelphia 3, Pa.

BUSHINGS (Bronze)

Ampco Metal Inc., Dept. S-11, Milwaukee 4, Wis.
Cadman, A. W., Mfg. Co., 28th & Smallman St., Pittsburgh 22, Pa.
Johnson Bronze Co., 550 S. Mill St., New Castle, Pa.
Moraine Products Div., General Motors Corp., Dayton 1, O.
National Bearing Metals Corp., 4930 Manchester Ave., St. Louis 10, Mo.
Shenango-Penn Mold Co., 444 W. Third St., Dover, O.
Wagner, E. R., Mfg. Co., 4615 N. 32nd St., Milwaukee 9, Wis.

BUSHINGS (Jig)

Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit 6, Mich.
Haynes Stellite Co., 30 E. 42nd St., New York 17, N. Y.
Universal Engineering Co., Frankenmuth, Mich.

BUSHINGS (Oilless)

Moraine Products Div., General Motors Corp., Dayton 1, O.
Rhoades, R. W., Metaline Co., Inc., 50-17 Fifth St., Long Island City 1, N. Y.

BUSHINGS (Silver)

Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.

BUTTS

Veeder-Root, Inc., Hartford 2, Conn.
Wagner, E. R., Mfg. Co., 4615 N. 32nd St., Milwaukee 9, Wis.

BY-PRODUCT PLANTS

Koppers Co., Engineering and Construction Div., 300 Koppers Bldg., Pittsburgh 19, Pa.

CABINETS (Refrigeration)

General Electric Company (Air Conditioning & Commercial Refrigeration Div., Sec. 4412), Bloomfield, N. J.
Motor Products Corp., Deep Freeze Div., 2309 Davis St., N. Chicago, Ill.
Westinghouse Electric & Mfg. Co. Mansfield, O.

CABINETS (Steel)

Brandt, Charles T., Inc., 1702 Ridgely St., Baltimore 30, Md.
Mullins Mfg. Co., Warren, O.
Republic Steel Corp., Berger Mfg. Div., Canton 5, O.

CABLE (Electric)—See WIRE & CABLE (Electric)

CABLE SUPPLIES (Electric Welding)

Punch-Lok Co., 321 N. Justine St., Chicago 7, Ill.

CADMIUM

American Zinc, Lead & Smelting Co., 943 Paul Brown Building, St. Louis 1, Mo.
Udylite Corp., The, 1651 E. Grand Blvd., Detroit 11, Mich.

CADMIUM PLATING PROCESSES AND EQUIPMENT

Udylite Corp., The, 1651 E. Grand Blvd., Detroit 11, Mich.

CAISSONS (Pneumatic)

Dravo Corp., (Contracting Div.), Neville Island, Pittsburgh 25, Pa.

CALCIUM METAL AND ALLOYS

Electro Metallurgical Co., 30 E. 42nd St., New York 17, N. Y.

CAMSHAFTS

Ladish Drop Forge Co., Cudahy, Wis.

CAP SCREWS—See SCREWS (Cap, Set, Safety-Set)

CAPACITORS (Electric)

Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.

CAPSTANS (Electric, Gasoline, Diesel)

Silent Hoist & Crane Co., 849 63rd St., Brooklyn 20, N. Y.

CAR DUMPERS

Alliance Machine Co., The, Alliance, O.
Industrial Brownhoist Corp., Bay City, Mich.
Link-Belt Co., 300 W. Pershing Road, Chicago 9, Ill.
Wellman Engineering Co., The, 7016 Central Ave., Cleveland 4, O.

CAR PULLERS and SPOTTERS

Cullen-Friestedt Co., 1308 S. Kilbourn Ave., Chicago 23, Ill.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.
Silent Hoist & Crane Co., 849 63rd St., Brooklyn 20, N. Y.
Vulcan Iron Works, Wilkes-Barre, Pa.

CARBIDE

Linde Air Products Co., The, 30 E. 42nd St., New York 17, N. Y.
National Carbide Corp., 60 E. 42nd St., New York 17, N. Y.
Shawinigan Products Corp., Empire State Bldg., New York 1, N. Y.

CARBIDE METALS (Special Parts)

Firth-Sterling Steel Co., McKeesport, Pa.
Kennametal, Inc., 200 Lloyd Ave., Latrobe, Pa.
Vascoloy-Ramet Corp., N. Chicago, Ill.

CARBIDE TOOLS (Steel Cutting)

Carboloy Co., Inc., 11141 E. 8 Mile Blvd., Detroit 32, Mich.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit 6, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Genesee Tool Co., Fenton, Mich.
Kennametal, Inc., 200 Lloyd Ave., Latrobe, Pa.
Scully-Jones & Co., 1901 S. Rockwell St., Chicago 8, Ill.
Vascoloy-Ramet Corp., N. Chicago, Ill.

CARBON SPECIALTIES

National Carbon Co., Inc., 30 E. 42nd St., New York 17, N. Y.

CARBURIZING (Pack or Gas)

Burgess-Norton Mfg. Co., 778 Peyton St., Geneva, Ill.
Geneva, Ill.
Commercial Metals Treating, Inc., 177 S. St. Clair St., Toledo 1, O.
Follansbee Steel Corp., Third & Liberty Sts., Pittsburgh 30, Pa.
Lakeside Steel Improvement Co., The, 5418 Lakeside Ave., Cleveland 14, O.
U. S. Automatic Corp., Amherst, O.

CARS (Charging)

Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland 10, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Foundry & Machine Co., E. Chicago, Ind.
Morgan Engineering Co., The, Alliance, O.

CARS (Dump)

Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland 10, O.
Bethlehem Steel Co., Bethlehem, Pa.
Differential Steel Car Co., Findlay, O.
Easton Car & Construction Co., Easton, Pa.
Pressed Steel Car Co., Inc., (Industrial Div.) Grant Bldg., Pittsburgh 19, Pa.

CARS (Hot Metal Transfer)

Bartlett Hayward Div., Koppers Co., Baltimore 3, Md.

CARS (Industrial and Mining)

Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland 10, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Differential Steel Car Co., Findlay, O.
Easton Car & Construction Co., Easton, Pa.
Pittsburgh Steel Foundry Corp., Glassport, Pa.
Pressed Steel Car Co., Inc., (Industrial Div.) Grant Bldg., Pittsburgh 19, Pa.

CARS (Scale)

Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland 10, O.

CASTING WASHER EQUIPMENT

Pangborn Corporation, Hagerstown, Md.

CASTINGS (Acid Resisting)

Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
Ampco Metal Inc., Dept. S-11, Milwaukee 4, Wis.
Babcock & Wilcox Co., The, 85 Liberty St., New York 6, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Cadman, A. W., Mfg. Co., 28th & Smallman St., Pittsburgh 22, Pa.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Haynes Stellite Co., 30 E. 42nd St., New York 17, N. Y.
Hedstrom, Oscar W., Corp., 4824 W. Division St., Chicago 51, Ill.
International Nickel Co., Inc., The, 67 Wall St., New York 5, N. Y.
Lebanon Steel Foundry, Lebanon, Pa.
Midvale Co., The, Nicetown, Philadelphia 40, Pa.
National Alloy Steel Div. of Blaw-Knox Co., Blawnox, Pa.
Ohio Steel Foundry Co., Lima & Springfield, O.
Shenango-Penn Mold Co., 444 W. Third St., Dover, O.

CASTINGS (Alloy Iron)

Bethlehem Steel Co., Bethlehem, Pa.
Commercial Iron Works, P. O. Box 2230, Portland 14, Oreg.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
National Alloy Steel Div. of Blaw-Knox Co., Blawnox, Pa.

CASTINGS (Alloy Steel)

Advance Foundry Co., The, 100 Parnell Ave., Dayton 3, O.
Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
Babcock & Wilcox Co., The, 85 Liberty St., New York 6, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Foundry & Machine Co., E. Chicago, Ind.
Electro-Alloys Co., Elyria, O.
Lebanon Steel Foundry, Lebanon, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
Michiana Products Co., Michigan City, Ind.
National Alloy Steel Div. of Blaw-Knox Co., Blawnox, Pa.
Ohio Steel Foundry Co., Lima & Springfield, O.
Pittsburgh Steel Foundry Corp., Glassport, Pa.
Taylor-Wharton Iron & Steel Co., Easton, Pa.
Union Steel Castings Div. of Blaw-Knox Co., 62nd & Butler Sts., Pittsburgh 1, Pa.
United Engineering & Foundry Co., 1st National Bank Bldg., Pittsburgh 22, Pa.

CASTINGS (Aluminum, Brass, Bronze, Copper)

Acme Pattern & Tool Co., Inc., 232 Findlay St., Dayton 3, O.
Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
Aluminum Industries, Inc., 2438 Beekman St., Cincinnati 25, O.
Ampco Metal Inc., Dept. S-11, Milwaukee 4, Wis.
Bartlett-Hayward Div., Koppers Co., Baltimore 3, Md.
Bethlehem Steel Co., Bethlehem, Pa.
Bohn Aluminum & Brass Corp., Lafayette Bldg., Detroit 26, Mich.
Bunting Brass & Bronze Co., The, 715 Spencer St., Toledo 1, O.
Cadman, A. W., Mfg. Co., 28th & Smallman St., Pittsburgh 22, Pa.
Century Foundry Co., 3727 Market St., St. Louis 10, Mo.
Commercial Iron Works, P. O. Box 2230, Portland 14, Oreg.
Doehler Die Casting Co., Smead Ave., Toledo 1, O.
Grinnell Co., Inc., Providence 1, R. I.
Harvill, H. L., Mfg. Co., P. O. Box K, Vernon, Cal.
Hedstrom, Oscar W., Corp., 4824 W. Division St., Chicago 51, Ill.
Homestead Valve Mfg. Co., P. O. Box 22, Coraopolis, Pa.
Johnson Bronze Co., 550 S. Mill St., New Castle, Pa.
Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
Morgan Engineering Co., The, Alliance, O.
National Bearing Metals Corp., 4930 Manchester Ave., St. Louis 10, Mo.
Permold Co., The, 830 W. Liberty St., Medina, O.
Shenango-Penn Mold Co., 444 W. Third St., Dover, O.
Titan Metal Mfg. Co., Bellefonte, Pa.
Wellman Bronze & Aluminum Co., The, 2539 E. 93 St., Cleveland 4, O.

CASTINGS (Centrifugal)

Ampco Metal Inc., Dept. S-11, Milwaukee 4, Wis.
Bethlehem Steel Co., Bethlehem, Pa.
Harvill, H. L., Mfg. Co., P. O. Box K, Vernon, Cal.
Lebanon Steel Foundry, Lebanon, Pa.
Michiana Products Co., Michigan City, Ind.
Ohio Steel Foundry Co., Lima, O.
Shenango-Penn Mold Co., 444 W. Third St., Dover, O.

CASTINGS (Corrosion Resisting)

Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Haynes Stellite Co., 30 E. 42nd St., New York 17, N. Y.
Hedstrom, Oscar W., Corp., 4824 W. Division St., Chicago 51, Ill.
International Nickel Co., Inc., The, 67 Wall St., New York 5, N. Y.
Lebanon Steel Foundry, Lebanon, Pa.
Michiana Products Corp., Michigan City, Ind.
Midvale Co., The, Nicetown, Philadelphia 40, Pa.
National Alloy Steel Div. of Blaw-Knox Co., Blawnox, Pa.
National Lead Co., 111 Broadway, New York 6, N. Y.
Ohio Steel Foundry Co., Lima & Springfield, O.
Shenango-Penn Mold Co., 444 W. Third St., Dover, O.

CASTINGS (Electric Steel)

Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Foundry & Machine Co., E. Chicago, Ind.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Lebanon Steel Foundry, Lebanon, Pa.
Ohio Steel Foundry Co., Lima & Springfield, O.
Reading Steel Casting Div. of American Chain & Cable Co., Inc., Reading, Pa.

CASTINGS (Gray Iron, Alloy or Semi-Steel)

Advance Foundry Co., The, 100 Parnell Ave., Dayton 3, O.
Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Bartlett-Hayward Div., Koppers Co., Baltimore 3, Md.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Century Foundry Co., 3727 Market St., St. Louis 10, Mo.
Columbia Steel Co., San Francisco 6, Calif.
Commercial Iron Works, P. O. Box 2230, Portland 14, Oreg.
Davenport-Besler Corp., Davenport, Iowa
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Grinnell Co., Inc., Providence 1, R. I.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh 3, Pa.
Hyde Park Foundry & Machine Co., Hyde Park, Pa.
International Nickel Co., Inc., The, 67 Wall St., New York 5, N. Y.
Medart Co., The, 3500 DeKalb St., St. Louis 18, Mo.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
National Roll & Foundry Co., The, Avonmore, Pa.
Oil Well Supply Co., Dallas 1, Tex.
Shenango-Penn Mold Co., 444 W. Third St., Dover, O.
Taylor-Wilson Mfg. Co., 15 Thomson Ave., McKees Rocks, Pa.

CASTINGS (Heat Resisting)

Advance Foundry Co., The, 100 Parnell Ave., Dayton 3, O.
Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
Babcock & Wilcox Co., The, 85 Liberty St., New York 6, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Electro-Alloys Co., Elyria, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Haynes Stellite Co., 30 E. 42nd St., New York 17, N. Y.
Hedstrom, Oscar W., Corp., 4824 W. Division St., Chicago 51, Ill.
International Nickel Co. Inc., The, 67 Wall St., New York 5, N. Y.
Lebanon Steel Foundry, Lebanon, Pa.
Michiana Products Co., Michigan City, Ind.
Midvale Co., The, Nicetown, Philadelphia 40, Pa.
National Alloy Steel Div. of Blaw-Knox Co., Blawnox, Pa.
Ohio Steel Foundry Co., Lima & Springfield, O.
Shenango-Penn Mold Co., 444 W. Third St., Dover, O.

CASTINGS (Magnesium)

Aluminum Industries, Inc., 2438 Beekman St., Cincinnati 25, O.
Bohn Aluminum & Brass Corp., Lafayette Bldg., Detroit 26, Mich.
Dow Chemical Co., The, Midland, Mich.
Harvill, H. L., Mfg. Co., P. O. Box K, Vernon, Cal.
Light Metals, Inc., 1100-1198 E. 24th St., Indianapolis 5, Ind.
Wellman Bronze & Aluminum Co., The, 2539 E. 93rd St., Cleveland 4, O.

CASTINGS (Malleable)

American Chain Div., American Chain & Cable Co. Inc., York, Pa.
Grinnell Co., Inc., Providence 1, R. I.

CASTINGS (Malleable) (Con.)

Lake City Malleable Co., The, 5026 Lakeside Ave., Cleveland 14, O.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Saginaw Malleable Iron Div. General Motors Corp., Saginaw, Mich.

CASTINGS (Permanent-Mold)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
Doehler Die Casting Co., Smead Ave., Toledo 1, O.
Harvill, H. L., Mfg. Co., P. O. Box K, Vernon, Cal.
Permold Co., The, 830 W. Liberty St., Medina, O.

CASTINGS (Steel) (*Also Stainless)

*Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
American Rolling Mill Co., The, 3361 Curtis St., Middletown, O.
Babcock & Wilcox Co., The, 85 Liberty St., New York 6, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco 6, Cal.
Continental Foundry & Machine Co., E. Chicago, Ind.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
*Lebanon Steel Foundry, Lebanon, Pa.
Mackintosh-Hemphill Co., 9th & Bingham Sts., Pittsburgh 3, Pa.
Mesta Machine Co., P. O. Box 1466 Pittsburgh 30, Pa.
*Michiana Products Co., Michigan City, Ind.
*Midvale Co., The, Nicetown, Philadelphia 40, Pa.
National Roll & Foundry Co., The, Avonmore, Pa.
*Ohio Steel Foundry Co., Lima & Springfield, O.
Oil Well Supply Co., Dallas 1, Tex.
Pittsburgh Steel Foundry Corp., Glassport, Pa.
Saginaw Malleable Iron Div. General Motors Corp., Saginaw, Mich.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia 42, Pa.
Steel Founders' Society of America, 920 Midland Bldg., Cleveland 15, O.
Strong Steel Fdry. Co., Hertel & Norris Aves., Buffalo 7, N. Y.
Taylor-Wharton Iron & Steel Co., Easton, Pa.
Union Steel Casting Div. of Blaw-Knox Co., 62nd and Butler Sts., Pittsburgh 1, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh 22, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.

CASTINGS (Wear Resisting)

Bethlehem Steel Co., Bethlehem, Pa.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Hagan, George J., Co., 2400 E. Carson St., Pittsburgh 3, Pa.
Haynes Stellite Co., 30 E. 42nd St., New York 17, N. Y.
Lebanon Steel Foundry, Lebanon, Pa.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Michiana Products Corp., Michigan City, Ind.
National Alloy Steel Div., Blaw-Knox Co., Blawnox, Pa.
Ohio Steel Foundry Co., Lima & Springfield, O.
Pittsburgh Steel Foundry Corp., Glassport, Pa.
Saginaw Malleable Iron Div., General Motors Corp., Saginaw, Mich.
Shenango-Penn Mold Co., 444 W. Third St., Dover, O.
Taylor-Wharton Iron & Steel Co., Easton, Pa.

CASTINGS (Worm and Gear Bronze)

Ampco Metal Inc., Dept. S-11, Milwaukee 4, Wis.
Cadman, A. W., Mfg. Co., 28th & Smallman Sts., Pittsburgh 22, Pa.
Shenango-Penn Mold Co., 444 W. Third St., Dover, O.

CEMENT (Acid Proof)

National Carbon Co., Inc., 30 E. 42nd St., New York 17, N. Y.
Pennsylvania Salt Mfg. Co., 1000 Widener Bldg., Philadelphia 7, Pa.

CEMENT (Elastic)

Minnesota Mining & Mfg. Co., 900 Fauquier St., St. Paul 6, Minn.

CEMENT (High Temperature)

Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York 6, N. Y.
Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., The, Perth Amboy, N. J.
Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.
Johns-Manville Corp., 22 E. 40th St., New York 16, N. Y.
Norton Company, Worcester 6, Mass.
Pennsylvania Salt Mfg. Co., 1000 Widener Bldg., Philadelphia 7, Pa.

CEMENT (High Temperature Hydraulic)

Atlas Lumnite Cement Co., Dept. S, Chrysler Bldg., New York 17, N. Y.
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York 6, N. Y.

CENTERING MACHINES

Mercury Products Co., 423 Euclid Ave., Cleveland 14, O.

CENTRAL STATION EQUIPMENT

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
General Electric Co., Schenectady 5, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Sturtevant, B. F., Co., Hyde Park, Boston 36, Mass.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

CHAIN (Conveyor and Elevator)

Cleveland Chain & Mfg. Co., The, Broadway & Henry Rd., Garfield Heights, O.
Jeffrey Mfg. Co., The, 889-99 N. Fourth St., Columbus 16, O.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Taylor-Wharton Iron & Steel Co., Easton, Pa.
Union Chain & Mfg. Co., Sandusky, O.

CHAIN (Draw Bench)

Cleveland Chain & Mfg. Co., The, Broadway & Henry Rd., Garfield Heights, O.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Union Chain & Mfg. Co., Sandusky, O.

CHAIN (Malleable)

Cleveland Chain & Mfg. Co., The, Broadway & Henry Rd., Garfield Heights, O.
Jeffrey Mfg. Co., The, 889-99 N. Fourth St., Columbus 16, O.
Lake City Malleable Co., The, 5026 Lakeside Ave., Cleveland 14, O.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Medart Co., The, 3500 DeKalb St., St. Louis 18, Mo.

CHAIN (Power Transmission)

Jeffrey Mfg. Co., The, 889-99 N. Fourth St., Columbus 16, O.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Union Chain & Mfg. Co., Sandusky, O.

CHAIN (Roller)

Industrial Gear Mfg. Co., 4545 W. Van Buren St., Chicago 24, Ill.
Jeffrey Mfg. Co., The, 889-99 N. Fourth St., Columbus 16, O.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Union Chain & Mfg. Co., Sandusky, O.

CHAIN (Sling)

American Chain Div., American Chain & Cable Co., Inc., York, Pa.
Cleveland Chain & Mfg. Co., The, Broadway & Henry Rd., Garfield Heights, O.
Columbus-McKinnon Chain Corp., 118 Fremont Ave., Tonawanda, N. Y.
McKay Co., The, York, Pa.

CHAIN (Welded & Weldless)

American Chain Div., American Chain & Cable Co. Inc., York, Pa.
Cleveland Chain & Mfg. Co., The, Broadway & Henry Rd., Garfield Heights, O.
Columbus-McKinnon Chain Corp., 118 Fremont Ave., Tonawanda, N. Y.
McKay Co., The, York, Pa.
United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.

CHANNELS—See BEAMS, CHANNELS, ANGLES

CHARGING BOXES

Pittsburgh Steel Foundry Corp., Glassport, Pa.
Union Steel Castings Div. of Blaw-Knox Co., 62nd & Butler Sts., Pittsburgh 1, Pa.

CHARGING MACHINES (Cupola)

Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland 10, O.
Morgan Engineering Co., The, Alliance, O.

CHARGING MACHINES (Open Hearth)

Morgan Engineering Co., The, Alliance, O.
Wellman Engineering Co., The, 7016 Central Ave., Cleveland 4, O.

CHECKER BRICK

Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York 6, N. Y.
Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh 22, Pa.

CHECKS (Metal)

Cunningham, M. E., Co., 172 E. Carson St., Pittsburgh 19, Pa.
Grammes, L. F., & Sons, Inc., Allentown, Pa.
Matthews, Jas. H., & Co., 3978 Forbes St., Pittsburgh 13, Pa.

CHEMICAL PROCESSING EQUIPMENT

Blaw-Knox Div. of Blaw-Knox Co., Blawnox, Pa.
Brandt, Charles T., Inc., 1702 Ridgely St., Baltimore 30, Md.
Hall, C. M., Lamp Co., 1005 E. Hancock St., Detroit 7, Mich.
Haynes Stellite Co., 30 E. 42nd St., New York 17, N. Y.
Struthers Wells Corp., Titusville, Pa.
Youngstown Welding & Eng. Co., The, 3711 Oakwood Ave., Youngstown 9, O.

CHEMICALS (Industrial)

American Chemical Paint Co., Ambler, Pa.
General Chemical Co., 40 Rector St., New York 6, N. Y.
Holden, A. F., Co., The, P. O. Box 1898, New Haven 8, Conn.
Kelite Products Inc., 909 E. 60th St., Los Angeles 1, Cal.
Metal & Thermit Corp., 120 Broadway, New York 5, N. Y.
Pennsylvania Salt Mfg. Co., 1000 Widener Bldg., Philadelphia 7, Pa.
Turco Products, Inc., 6135 S. Central Ave., Los Angeles 54, Cal.
Wilkens-Anderson Co., 111 No. Canal St., Chicago 6, Ill.

CHEMICALS (Laboratory)

Baker & Adamson Div. General Chemical Co., 40 Rector St., New York 6, N. Y.

CHILLING EQUIPMENT (Metal)

Motor Products Corp., Deep Freeze Div., 2309 Davis St., N. Chicago, Ill.

CHROME MORTAR

Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York 6, N. Y.
Harbison-Walker Refractories Co. 1800 Farmers Bank Bldg. Pittsburgh 22, Pa.

CHROME ORE

Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York 6, N. Y.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia 2, Pa.

CHROMIUM METAL AND ALLOYS

Electro Metallurgical Co., 30 E. 42nd St., New York 17, N. Y.
Metal & Thermit Corp., 120 Broadway, New York 5, N. Y.

CHROME PLATING (Porous)

Van Der Horst Corp. of America, 12500 Berea Rd., Cleveland 11, O.

CHROMIUM PLATING PROCESSES AND EQUIPMENT

United Chromium, Inc., 51 E. 42nd St., New York 17, N. Y.
Van Der Horst Corp. of America, 12500 Berea Rd., Cleveland 11, O.

CHUCK OPERATING CYLINDERS

Anker Holth Mfg. Co., 332 S. Michigan Ave., Chicago 4, Ill.

CHUCKING MACHINES (Multiple Spindle)

Bullard Co., The, Bridgeport 2, Conn.
Cross Co., The, 3250 Bellevue Ave., Detroit 7, Mich.
National Acme Co., The, 170 E. 131st St., Cleveland 8, O.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland 3, O.

CHUCKS

Apex Machine & Tool Co., 1025 S. Patterson Blvd., Dayton 1, O.
Bullard Co., The, Bridgeport 2, Conn.
Lee, K. O., Company, Aberdeen, S. Dak.
Scully-Jones & Co., 1901 S. Rockwell St., Chicago 8, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, O.

CHUCKS (Automatic Closing)

Anker-Holth Mfg. Co., 332 S. Michigan Ave., Chicago 4, Ill.

CLAMPS, CABLE (Sheet Metal)

Tinnerman Products, Inc., 2039 Fulton Rd., Cleveland 13, O.

CLAMPS (Drop Forged)

Siewek Tool Co., Div. Domestic Industries Inc., 231 S. LaSalle St., Chicago 4, Ill.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

CLAMPS (Pipe Repair)

Dresser Manufacturing Co., Bradford, Pa.

CLAMPS (Plate Lifting)

Merrill Brothers, 56-04 Arnold Ave., Maspeth, L. I., N. Y.

CLAMPS (Toggle)

Danly Machine Specialties, Inc., 2100 S. 52nd Ave., Chicago 50, Ill.

CLEANERS (Oil and Grease Absorbent)

Refiners Lubricating Co., 601 W. 26th St., New York 1, N. Y.
Waverly Petroleum Products Co., Drexel Bldg., Philadelphia 6, Pa.

CLEANERS (Steam)

Homestead Valve Mfg. Co., P. O. Box 22, Coraopolis, Pa.
Oakite Products, Inc., 34E Thames St., New York 6, N. Y.
Pennsylvania Salt Mfg. Co., Dept. S, Pennsalt Cleaner Div., Philadelphia 7, Pa.

CLEANERS AND FILTERS (Air)

Adams, R. P., Co., Inc., 75 Chicago St., Buffalo 4, N. Y.
American Air Filter Co., Inc., 443 Central Ave., Louisville 8, Ky.
Moraine Products Div., General Motors Corp., Dayton 1, O.
Pesco Products Co., 11610 Euclid Ave., Cleveland 6, O.
Westinghouse Electric & Mfg. Co., 1216 W. 58th St., Cleveland 1, O.

CLEANING EQUIPMENT (Metal)

Alvey-Ferguson Co., The, 85 Disney St., Cincinnati 9, O.
American Foundry Equipment Co., 509 S. Byrkit St., Mishawaka, Ind.
Bullard Co., The, Bridgeport 2, Conn.
Holden, A. F., Co., The, P. O. Box 1898, New Haven 8, Conn.
Meaker Co., The, 1635 S. 55th Ave., Chicago 50, Ill.
Pangborn Corporation, Hagerstown, Md.
Ransohoff, N., Inc., 1317 Township Ave., Cincinnati 16, O.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Wean Engineering Co., Inc., The, Warren, O.

CLEANING & MAINTENANCE EQUIPMENT (Floors)

Tennant, G. H., Co., 2530 N. Second St., Minneapolis 11, Minn.

CLEANING SPECIALTIES

American Chemical Paint Co., Ambler, Pa.
Kelite Products Inc., 909 E. 60th St., Los Angeles 1, Cal.
Kondor Products Corp., 18120 Sloane Ave., Lakewood 7, O.
Oakite Products Inc., 34E Thames St., New York 6, N. Y.
Pennsylvania Salt Mfg. Co., Dept. S, Pennsalt Cleaner Div., Philadelphia 7, Pa.
Turco Products, Inc., 6135 S. Central Ave., Los Angeles 54, Cal.

CLOTHING (Safety)

Wahlert Products Corp., 27 Lafayette St., Brooklyn 1, N. Y.

CLUTCH DISCS

Burgess-Norton Mfg. Co., 778 Peyton St., Geneva, Ill.
Twin Disc Clutch Co., 1379 Racine Ave., Racine, Wis.

CLUTCH FACINGS

Johns-Manville Corp., 22 E. 40th St., New York 16, N. Y.

CLUTCHES (Friction)

Dodge Manufacturing Corp., Mishawaka, Ind.
Jones, W. A., Fdry. & Mach. Co., 4437 Roosevelt Rd., Chicago 24, Ill.
Link-Belt Co., 300 W. Pershing Road, Chicago 9, Ill.
Medart Co., The, 3500 DeKalb St., St. Louis 18, Mo.
Twin Disc Clutch Co., 1379 Racine Ave., Racine, Wis.

CLUTCHES (Magnetic)

Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee 1, Wis.

COAL OR COKE

Alan Wood Steel Co., Conshohocken, Pa.
Cleveland-Cliffs Iron Co., The, Union Commerce Bldg., Cleveland 14, O.
Hanna Furnace Corp., The, Ecorse, Detroit 18, Mich.
Koppers Co., Gas & Coke Div., 300 Koppers Bldg., Pittsburgh 19, Pa.
Koppers Coal Div., Eastern Gas & Fuel Assoc., 300 Koppers Bldg., Pittsburgh 19, Pa.
New England Coal & Coke Co., Boston 16, Mass.
Shenango Furnace Co., Oliver Bldg., Pittsburgh 22, Pa.
Snyder, W. P., & Co., Oliver Bldg., Pittsburgh 22, Pa.

COAL, COKE, ORE, ASH HANDLING AND PROCESSING MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland 10, O.
Bethlehem Steel Co., Bethlehem, Pa.
Easton Car & Construction Co., Easton, Pa.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh 3, Pa.
Industrial Brownhoist Corp., Bay City, Mich.
Jeffrey Mfg. Co., The, 889-99 N. Fourth St., Columbus 16, O.
Koppers Co., Engineering & Construction Div., 300 Koppers Bldg., Pittsburgh 19, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Syntron Co., 370 Lexington Ave., Homer City, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.
Wellman Engineering Co., The, 7016 Central Ave., Cleveland 4, O

COILERS (Strip & Wire)

Lewis Fdry & Mach. Div. of Blaw-Knox Co., Pittsburgh 30, Pa.

COILS (Direct Expansion)

General Electric Company (Air Conditioning & Commercial Refrigeration Div. Sec. 4412), Bloomfield, N. J.
Westinghouse Electric & Mfg. Co., 653 Page Blvd., Springfield 2, Mass.

COILS (Electrical)

Anaconda Wire & Cable Co., 25 Broadway, New York 4, N. Y.

COILS (Water or Steam)

General Electric Company (Air Conditioning & Commercial Refrigeration Div. Sec. 4412), Bloomfield, N. J.
Westinghouse Electric & Mfg. Co., 653 Page Blvd., Springfield 2, Mass.

COKE—See COAL or COKE

COKE OVEN MACHINERY

Alliance Machine Co., The Alliance, O.
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland 10, O.
Koppers Co., Engineering & Construction Div., 300 Koppers Bldg., Pittsburgh 19, Pa.
Morgan Engineering Co., The, Alliance, O.

COKE OVEN (By-Product)

Koppers Co., Engineering and Construction Div., 300 Koppers Bldg., Pittsburgh 19, Pa.

COLLET CHUCKS

Scully-Jones & Co., 1901 S. Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth, Mich.

COLLETS

Scully-Jones & Co., 1901 S. Rockwell St., Chicago 8, Ill.

COLUMBIUM

Electro Metallurgical Co., 30 E. 42nd St., New York 17, N. Y.

COMBUSTION BOATS

Carborundum Co., The, Niagara Falls, N. Y.
Norton Company, Worcester 6, Mass.

COMBUSTION CONTROLS

Electric Eye Equipment Co., 11 W. Fairchild St., Danville, Ill.
Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia 44, Pa.
Morgan Construction Co., Worcester 5, Mass.
Norton Company, Worcester 6, Mass.

COMPARATORS (Optical)

Jones & Lamson Machine Co., Springfield, Vt.

COMPENSATORS (Automatic)

Electric Controller & Mfg. Co., The, 2698 E. 79th St., Cleveland 4, O.
General Electric Co., Schenectady 5, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Square D Co., 4041 N. Richards St., Milwaukee 12, Wis.
Westinghouse Electric & Mfg. Co., Dept. 7N, E. Pittsburgh, Pa.

COMPOUNDS (Case Hardening, Heat Treating)

Holden, A. F., Co., The, P. O. Box 1898, New Haven 8, Conn.

COMPOUNDS (Copper, Metal Finishing, Rust Removing, Rust Preventing)

American Chemical Paint Co., Ambler, Pa.
Kelite Products Inc., 909 E. 60th St., Los Angeles 1, Cal.
Kondor Products Corp., 18120 Sloane Ave., Lakewood 7, O.
Oakite Products, Inc., 34E Thames St., New York 6, N. Y.
Rheem Research Products, Inc., 2523 Pennsylvania Ave., Baltimore 17, Md.
Turco Products, Inc., 6135 S. Central Ave., Los Angeles 54, Cal.

COMPOUNDS (Drawing & Stamping)

Oakite Products, Inc., 34E Thames St., New York 6, N. Y.

COMPOUNDS (Floor Cleaning)

Kelite Products Inc., 909 E. 60th St., Los Angeles 1, Cal.
Oakite Products, Inc., 34E Thames St. New York 6, N. Y.
Tennant, G. H., Co., 2530 N. Second St., Minneapolis 11, Minn.
Turco Products, Inc., 6135 S. Central Ave., Los Angeles 54, Cal.

COMPRESSORS (Air)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Cooper-Bessemer Corp., The, Mt. Vernon, O.
Curtis Pneumatic Machinery Div. of Curtis Mfg. Co., 1996 Kienlen Ave., St. Louis 20, Mo.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Sturtevant, B. F. Co., Hyde Park, Boston 36, Mass.

CONCRETE (Heat Resistant)

Atlas Lumnite Cement Co., Dept. S, Chrysler Bldg., New York, 17, N. Y.
Babcock & Wilcox Co., Refractories Div., 85 Liberty St., New York, 6, N. Y.

CONCRETE REINFORCING BARS —See BARS (Concrete Reinforcing)

CONDENSERS (Evaporative)

Niagara Blower Co., Dept. S-54, 6 E. 45th St., New York 17, N. Y.

CONDENSERS (Surface, Barometric, Multi-Jet)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
General Electric Company (Air Conditioning & Commercial Refrigeration Div. Sec. 4412), Bloomfield, N. J.
Harrisburg Steel Corp., Harrisburg, Pa.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
National Carbon Co., Inc., 30 E. 42nd St., New York 17, N. Y.
Ross Heater & Mfg. Co., Inc., 1431 West Ave., Buffalo 13, N. Y.
Westinghouse Electric & Mfg. Co., 653 Page Blvd., Springfield 2, Mass.

CONDUITS (Asbestos Cement)

Johns-Manville Corp., 22 E. 40th St., New York 16, N. Y.

CONDUITS (Electric)

Anaconda Wire & Cable Co., 25 Broadway, New York 4, N. Y.
General Electric Co., Schenectady 5, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Steel and Tubes Div., Republic Steel Corp., 226 E. 131st St., Cleveland 8, O.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

CONDUITS (Wood)

Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Koppers Co., Wood Preserving Div., 300 Koppers Bldg., Pittsburgh 19, Pa.

CONNECTING RODS

Heppenstall Co., Dept. TP, 4620 Hatfield St., Pittsburgh 1, Pa.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago 50, Ill.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia 42, Pa.

CONTACTS & CONTACTORS (Electric)

Clark Controller Co., The, 1146 E. 152nd St., Cleveland 10, O.
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee 1, Wis.
Electric Controller & Mfg. Co., The, 2698 E. 79th St., Cleveland 4, O.
General Electric Co., Schenectady 5, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.
National Carbon Co., Inc., 30 E. 42nd St., New York 17, N. Y.
Square D Co., 4041 N. Richards St., Milwaukee 12, Wis.
Ward Leonard Electric Company, 65 South St., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

CONTRACT WORK

Brandt, Charles T., Inc., 1702 Ridgely St., Baltimore 30, Md.
Bridgewater Screw Products Co., Bridgewater, Mass.
Burgess-Norton Mfg. Co., 778 Peyton St., Geneva, Ill.
Commercial Metals Treating Inc., 177 S. St. Clair St., Toledo 1, O.
Cross Co., The, 3250 Bellevue Ave., Detroit 7, Mich.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.
Nilson, A. H., Machine Co., Inc. Bridgeport 5, Conn.

CONTRACTORS—See ENGINEERS AND CONTRACTORS

CONTROL EQUIPMENT (Electric)

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
Allis-Chalmers Mfg. Co., Milwaukee 11, Wis.
Clark Controller Co., The, 1146 E. 152nd St., Cleveland 10, O.
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee 1, Wis.
Electric Controller & Mfg. Co., The, 2698 E. 79th St., Cleveland 4, O.
Electric Eye Equipment Co., 11 W. Fairchild St., Danville, Ill.
General Electric Co., Schenectady 5, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Square D Co., 4041 N. Richards St., Milwaukee 12, Wis.
Ward Leonard Electric Co., 65 South St., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

CONTROL SYSTEMS (Automatic)

Brown Instrument Co., The, Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia 44, Pa.
Electric Eye Equipment Co., 11 W. Fairchild St., Danville, Ill.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia 44, Pa.
Pesco Products Co., 11610 Euclid Ave., Cleveland 6, O.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

CONTROL SYSTEMS (Office, Tool, Production, Materials)

Remington-Rand Inc., Systems Div., 499 Washington St., Buffalo 3, N. Y.

CONTROLS (Combustion)—See COMBUSTION CONTROLS

CONTROLS (Temperature)

Brown Instrument Co., The, Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia 44, Pa.
Cooley Electric Mfg. Corp., 38 S. Shelby St., Indianapolis 7, Ind.
Electric Eye Equipment Co., 11 W. Fairchild St., Danville, Ill.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia 44, Pa.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

CONVEYING SYSTEMS (Steam Jet)

Hagan, George J., Co., 2400 E. Carson St., Pittsburgh 3, Pa.

CONVEYOR BELTS

Manheim Mfg. & Belting Co.
Manheim, Pa.
United States Rubber Co.,
Mechanical Goods Div., 1230
Sixth Ave., New York 20, N. Y.

CONVEYOR BELTS (High & Low Temperature)

Cyclone Fence Div., American Steel & Wire Co., Waukegan, Ill.
Wickwire Spencer Steel Co.,
500 Fifth Ave., New York 18, N.Y.

CONVEYOR BELTS (Wire)

Buffalo Wire Works Co., Inc., 437
Terrace Rd., Buffalo 2, N. Y.
Cyclone Fence Div., American Steel & Wire Co., Waukegan, Ill.
Wickwire Spencer Steel Co.,
500 Fifth Ave., New York 18, N.Y.

CONVEYORS (Apron)

Alvey-Ferguson Co., The,
85 Disney St., Cincinnati 9, O.
Lamson Corporation, 250 Lamson
St., Syracuse 1, N. Y.
Link-Belt Co., 300 W. Pershing Rd.,
Chicago 9, Ill.
Union Chain & Mfg. Co.,
Sandusky, O.

CONVEYORS (Belt)

Alvey-Ferguson Co., The,
85 Disney St., Cincinnati 9, O.
Lamson Corporation, 250 Lamson
St., Syracuse 1, N. Y.
Link-Belt Co.,
300 W. Pershing Rd.,
Chicago 9, Ill.

CONVEYORS (Chain)

Alvey-Ferguson Co., The,
85 Disney St., Cincinnati 9, O.
Jeffrey Mfg. Co., The, 889-99 N.
Fourth St., Columbus 16, O.
Lamson Corporation, 250 Lamson
St., Syracuse 1, N. Y.
Link-Belt Co., 220 S. Belmont Ave.,
Indianapolis 6, Ind.
Union Chain & Mfg. Co.,
Sandusky, O.
Vulcan Iron Works,
Wilkes-Barre, Pa.

CONVEYORS (Drag)

Lamson Corporation, 250 Lamson
St., Syracuse 1, N. Y.

CONVEYORS (Elevating)

Alvey-Ferguson Co., The,
85 Disney St., Cincinnati 9, O.
Jeffrey Mfg. Co., The, 889-99 N.
Fourth St., Columbus 16, O.
Link-Belt Co., 300 W. Pershing Rd.
Chicago 9, Ill.

CONVEYORS (Overhead)

Alvey-Ferguson Co., The,
85 Disney St., Cincinnati 9, O.
Lamson Corporation, 250 Lamson
St., Syracuse 1, N. Y.

CONVEYORS (Overhead Trolley)

Alvey-Ferguson Co., The,
85 Disney St., Cincinnati 9, O.
American MonoRail Co., The, 13102
Athens Ave., Cleveland 7, O.
Cleveland Tramrail Div. of the
Cleveland Crane & Engineering
Co., 1125 E. 283rd St.,
Wickliffe, O.
Lamson Corporation, 250 Lamson
St., Syracuse 1, N. Y.
Link-Belt Co., 2410 W. 18th St.,
Chicago 8, Ill.
Reading Chain & Block Corp.,
2102 Adams St., Reading Pa.

CONVEYORS (Pneumatic)

Brandt, Charles T., Inc., 1702
Ridgely St., Baltimore 30, Md.
Lamson Corporation, 250 Lamson
St., Syracuse 1, N. Y.
Mahon, R. C., Co., The, 8650 Mt.
Elliott Ave., Detroit 11, Mich.
Sturtevant, B. F., Co.,
Hyde Park, Boston 36, Mass.

CONVEYORS (Portable)

Alvey-Ferguson Co., The,
85 Disney St., Cincinnati 9, O.
Jeffrey Mfg. Co., The, 889-99 N.
Fourth St., Columbus 16, O.
Lamson Corporation, 250 Lamson
St., Syracuse 1, N. Y.

CONVEYORS (Roller—Power and Gravity)

Alvey-Ferguson Co., The,
85 Disney St., Cincinnati 9, O.
Lamson Corporation, 250 Lamson
St., Syracuse 1, N. Y.
Mesta Machine Co., P. O. Box 1466,
Pittsburgh 30, Pa.

CONVEYORS (Slat)

Alvey-Ferguson Co., The,
85 Disney St., Cincinnati 9, O.
Lamson Corporation, 250 Lamson
St., Syracuse 1, N. Y.
Union Chain & Mfg. Co.,
Sandusky, O.

CONVEYORS (Vibrating)

Ajax Flexible Coupling Co.,
4 English St., Westfield, N. Y.
Allis-Chalmers Mfg. Co.,
Milwaukee 1, Wis.
Lamson Corporation, 250 Lamson
St., Syracuse 1, N. Y.
Syntron Co., 370 Lexington Ave.,
Homer City, Pa.
Vulcan Iron Works,
Wilkes-Barre, Pa.

COOLERS (Liquid, Compressed Air, Gas)

Niagara Blower Co., Dept. S-54,
6 E. 45th St., New York 17, N. Y.
Ross Heater & Mfg. Co., Inc.,
1431 West Ave., Buffalo 13, N. Y.

COPPER—See METALS (Nonferrous)

COPPER OXIDE (Cuprous, Cupric)

Metals Refining Co., Div. of The
Glidden Co., 1717 Summer St.,
Hammond, Ind.

COPPER (Phosphorized)

Ajax Metal Co., Philadelphia 43, Pa.
American Brass Co., The,
Waterbury 88, Conn.
Revere Copper & Brass, Inc.
230 Park Ave., New York 17, N.Y.
Westinghouse Electric & Mfg. Co.,
Dept. 7-N, E. Pittsburgh, Pa.

COTTER PINS

American Chain Div., American
Chain & Cable Co., Inc., York, Pa.
Hindley Mfg. Co., Valley Falls, R. I.
Hubbard, M. D., Spring Co., 410
Central Ave., Pontiac 12, Mich.
Lamson & Sessions Co., The,
1971 W. 85th St., Cleveland 2, O.
National Screw & Mfg. Co., The,
2440 E. 75th St., Cleveland 4, O.

COUNTERBORES

Ex-Cell-O Corp., 1228 Oakman
Blvd., Detroit 6, Mich.
Genesee Tool Co., Fenton, Mich.
Haynes Stellite Co., 30 E. 42nd St.,
New York 17, N. Y.
Scully-Jones & Co., 1901 S. Rock-
well St., Chicago 8, Ill.

COUNTERSINKING MACHINES

Mercury Products Co., 423 Euclid
Ave., Cleveland 14, O.

COUNTING DEVICES

Electric Eye Equipment Co., 11 W.
Fairchild St., Danville, Ill.
Veeder-Root, Inc., Hartford 2, Conn.

COUPLINGS (Air Hose)

Cleveland Pneumatic Tool Co., The,
3781 E. 77th St., Cleveland 5, O.
Goodrich, B. F., Co., The, Akron, O.
Hansen Manufacturing Co., The,
1786 E. 27th St., Cleveland 14, O.
Ingersoll-Rand Co.,
11 Broadway, New York 4, N. Y
Independent Pneumatic Tool Co.,
600 W. Jackson Blvd.,
Chicago 6, Ill.

COUPLINGS (Flexible)

Ajax Flexible Coupling Co.,
4 English St., Westfield, N. Y.
American Flexible Coupling Div.,
J. A. Zurn Mfg. Co., 18th St. &
Pittsburgh Ave., Erie, Pa.
Bartlett-Hayward Div., Koppers Co.,
Baltimore 3, Md.
Dresser Mfg. Co., Bradford, Pa.
Electric Controller & Mfg. Co., The,
2698 E. 79th St., Cleveland 4, O.
Farrel-Birmingham Co., Inc.,
Ansonia, Conn.
Foote Bros. Gear & Machine Co.,
5225 S. Western Blvd.,
Chicago 9, Ill.
General Electric Co.,
Schenectady 5, N. Y.
Horsburgh & Scott Co., The, 5112
Hamilton Ave., Cleveland 14, O.
James, D. O., Mfg. Co., 1140 W.
Monroe St., Chicago 7, Ill.
Link-Belt Co., 220 S. Belmont Ave.,
Indianapolis 6, Ind.
Lovejoy Flexible Coupling Co., 4973
W. Lake St., Chicago 44, Ill.
Medart Co., The, 3500 DeKalb St.,
St. Louis 18, Mo.
Philadelphia Gear Works, Erie Ave.
& G St., Philadelphia 34, Pa.
Poole Fdy. & Mach. Co.,
Woodberry St., Baltimore 11, Md.

COUPLINGS (Flexible)—Con.

Thomas Flexible Coupling Co.,
Warren, Pa.
Union Chain & Mfg. Co.,
Sandusky, O.
Waldron, John, Corp.,
New Brunswick, N. J.
Westinghouse Electric & Mfg. Co.,
200 McCandless Ave.,
Pittsburgh 1, Pa.

COUPLINGS (Pipe)

Bethlehem Steel Co., Bethlehem, Pa.
Dresser Mfg. Co., Bradford, Pa.
Harrisburg Steel Corp.,
Harrisburg, Pa.
National Tube Co.
Frick Bldg., Pittsburgh 30, Pa.
Republic Steel Corp., Dept ST,
Cleveland 4, O.
Youngstown Sheet & Tube Co., The,
Youngstown 1, O.

COVERS (Wire)

Buffalo Wire Works Co., Inc., 437
Terrace Rd., Buffalo 2, N. Y.

CRADLES (Coil)

Littell, F. J., Machine Co., 4165 N.
Ravenswood Ave., Chicago 13, Ill.

CRANES (Charging)

Alliance Machine Co., The
Alliance, O.
Harnischfeger Corp., 4411 W.
National Ave., Milwaukee 14, Wis.
Morgan Engineering Co., The,
Alliance, O.
Shepard Niles Crane & Hoist Corp.,
358 Schuyler Ave.,
Montour Falls, N. Y.

CRANES (Crawler, Erection)

Harnischfeger Corp., 4411 W.
National Ave., Milwaukee 14, Wis.
Hughes-Keenan Co.,
585 Newman St., Mansfield, O.
Industrial Brownhoist Corp.,
Bay City, Mich.
Link-Belt Speeder Corp., 301 W.
Pershing Rd., Chicago 9, Ill.
Northwest Engineering Co., 28 E.
Jackson Blvd., Chicago 4, Ill.
Ohio Locomotive Crane Co.,
Bucyrus, O.
Osgood Co., The, Marion, O.

CRANES (Electric)

Alliance Machine Co., The,
Alliance, O.
American MonoRail Co., The,
13102 Athens Ave.,
Cleveland 7, O.
Browning, Victor R., & Co., Inc.,
Willoughby, O.
Chicago Tramrail Co., 2912 W. Car-
roll Ave., Chicago 12, Ill.
Chisholm-Moore Hoist Corp., 118
Fremont Ave., Tonawanda, N. Y.
Cleveland Crane & Engineering Co.,
The, 1125 E. 283rd St.,
Wickliffe, O.
Erie Steel Construction Co., Erie, Pa.
Euclid Crane & Hoist Co., The,
1365 Chardon Rd., Euclid, O.
Harnischfeger Corp., 4411 W.
National Ave., Milwaukee 14, Wis.
Morgan Engineering Co., The,
Alliance, O.
Reading Chain & Block Corp.,
2102 Adams St., Reading, Pa.
Shepard Niles Crane & Hoist Corp.,
358 Schuyler Ave.,
Montour Falls, N. Y.

CRANES (Gantry)

Alliance Machine Co., The
Alliance, O.
American MonoRail Co., The, 13102
Athens Ave., Cleveland 7, O.
Browning, Victor R., & Co., Inc.,
Willoughby, O.
Cleveland Crane & Engineering Co.,
The, 1125 E. 283rd St.,
Wickliffe, O.
Cullen-Friestedt Co., 1308 S.
Kilbourn Ave., Chicago 23, Ill.
Euclid Crane & Hoist Co., The,
1365 Chardon Rd., Euclid, O.
Harnischfeger Corp., 4411 W.
National Ave., Milwaukee 14, Wis.
Industrial Brownhoist Corp.,
Bay City, Mich.
Morgan Engineering Co., The,
Alliance, O.
Northwest Engineering Co., 28 E.
Jackson Blvd., Chicago 4, Ill.
Ohio Locomotive Crane Co.,
Bucyrus, O.
Reading Chain & Block Corp.,
2102 Adams St., Reading, Pa.
Shepard Niles Crane & Hoist Corp.,
358 Schuyler Ave.,
Montour Falls, N. Y.

CRANES (Gasoline and Diesel)

Cullen-Friestedt Co., 1308 S.
Kilbourn Ave., Chicago 23, Ill.
Harnischfeger Corp., 4411 W.
National Ave., Milwaukee 14, Wis.
Industrial Brownhoist Corp.,
Bay City, Mich.
Northwest Engineering Co., 28 E.
Jackson Blvd., Chicago 4, Ill.
Ohio Locomotive Crane Co.,
Bucyrus, O.
Silent Hoist & Crane Co.,
849 63rd St., Brooklyn 20 N. Y.

CRANES (Hand)

American MonoRail Co., The, 13102
Athens Ave., Cleveland 7, O.
Chicago Tramrail Co., 2912 W.
Carroll Ave., Chicago 12, Ill.
Chisholm-Moore Hoist Corp., 118
Fremont Ave., Tonawanda, N. Y.
Cleveland Crane & Engineering Co.,
The, 1125 E. 283rd St.,
Wickliffe, O.
Cleveland Tramrail Div. of The
Cleveland Crane & Engineering
Co., 1125 E. 283rd St.,
Wickliffe, O.
Curtiss Pneumatic Machinery Div. of
Curtiss Mfg. Co., 1996 Kienlen
Ave., St. Louis 20, Mo.
Euclid Crane & Hoist Co., The,
1365 Chardon Rd., Euclid, O.
Industrial Brownhoist Corp.,
Bay City, Mich.
Reading Chain & Block Corp.,
2102 Adams St., Reading, Pa.
Shepard Niles Crane & Hoist Corp.,
358 Schuyler Ave.,
Montour Falls, N. Y.
Wright Mfg. Div. of American Chain
& Cable Co., Inc., York, Pa.

CRANES (Jib)

Alliance Machine Co., The
Alliance, O.
American MonoRail Co., The, 13102
Athens Ave., Cleveland 7, O.
Chicago Tramrail Co., 2912 W.
Carroll Ave., Chicago 12, Ill.
Chisholm-Moore Hoist Corp., 118
Fremont Ave., Tonawanda, N. Y.
Cleveland Tramrail Div. of The
Cleveland Crane & Engineering
Co., 1125 E. 283rd St.,
Wickliffe, O.
Euclid Crane & Hoist Co., The,
1365 Chardon Rd., Euclid, O.
Harnischfeger Corp., 4411 W.
National Ave., Milwaukee 14, Wis.
Industrial Brownhoist Corp.,
Bay City, Mich.
Link-Belt Speeder Corp., 301 W.
Pershing Rd., Chicago 9, Ill.
Morgan Engineering Co., The,
Alliance, O.
Reading Chain & Block Corp.,
2102 Adams St., Reading, Pa.
Wright Mfg. Div. of American Chain
& Cable Co., Inc., York, Pa.

CRANES (Locomotive)

Cullen-Friestedt Co., 1308 S.
Kilbourn Ave., Chicago 23, Ill.
Harnischfeger Corp., 4411 W.
National Ave., Milwaukee 14, Wis.
Industrial Brownhoist Corp.,
Bay City, Mich.
Northwest Engineering Co., 28 E.
Jackson Blvd., Chicago 4, Ill.
Ohio Locomotive Crane Co.,
Bucyrus, O.
Osgood Co., The, Marion, O.
Silent Hoist & Crane Co.,
849 63rd St., Brooklyn 20, N. Y.

CRANES (Monorail)

American MonoRail Co., The, 13102
Athens Ave., Cleveland 7, O.
Chicago Tramrail Co., 2912 W.
Carroll Ave., Chicago 12, Ill.
Chisholm-Moore Hoist Corp., 118
Fremont Ave., Tonawanda, N. Y.
Cleveland Crane & Engineering
Co., The, 1125 E. 283rd St.,
Wickliffe, O.
Euclid Crane & Hoist Co., The
1365 Chardon Rd., Euclid, O.
Reading Chain & Block Corp.,
2102 Adams St., Reading, Pa.
Shepard Niles Crane & Hoist Corp.,
358 Schuyler Ave.,
Montour Falls, N. Y.

CRANES (Portable Electric)

Baker-Raulang Co., The, 2167
W. 25th St., Cleveland 13, O.

CRANES (Traveling)

American MonoRail Co., The, 13102 Athens Ave., Cleveland 7, O.
Chicago Tramrail Co., 2912 W. Carroll Ave., Chicago 12, Ill.
Chisholm-Moore Hoist Corp., 118 Fremont Ave., Tonawanda, N. Y.
Erie Steel Construction Co., Erie, Pa.
Euclid Crane & Hoist Co., The, 1365 Chardon Rd., Euclid, O.
Reading Chain & Block Corp., 2102 Adams St., Reading, Pa.
Wright Mfg. Div. of American Chain & Cable Co., Inc., York, Pa.

CRANES, BRIDGE (Ore and Coal Handling)

Alliance Machine Co., The Alliance, O.
Browning, Victor R., & Co., Inc. Willoughby, O.
Dravo Corp. (Engineering Works Div.,), Neville Island, Pittsburgh 25, Pa.
Industrial Brownhoist Corp., Bay City, Mich.
Wellman Engineering Co., The, 7016 Central Ave., Cleveland 4, O.

CRANKSHAFTS

Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago 50, Ill.
Ladish Drop Forge Co., Cudahy, Wis.
Midvale Co., The Nicetown, Philadelphia 40, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Ohio Crankshaft Co., The, 3800 Harvard Ave., Cleveland 1, O.
Union Drawn Steel Div., Republic Steel Corp., Massillon, O.

CRATING (Wood)

Morgan Lumber Sales Co., 8 E. Long St., Columbus, O.

CRAYONS (Metal Marking)

American Crayon Co., Sandusky, O.
United States Steel Supply Co., P. O. Box MM, Chicago 90, Ill.

CRUSHERS

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
American Pulverizer Co., 1539 Macklind Ave., St. Louis 10, Mo.
Birdsboro Steel Fdry. & Machine Co., Birdsboro, Pa.
Jeffrey Mfg. Co., The, 889-99 N. Fourth St., Columbus 16, O.
Vulcan Iron Works, Wilkes-Barre, Pa.

CUSHIONS (Pneumatic)

Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland 14, O.

CUTTERS (Bar and Bar Products)

Bokum Tool Co., 14775 Wildermere Ave., Detroit 21, Mich.
Lewthwaite, T. H., Machine Co., Inc., 311 E. 47th St., New York 17, N. Y.
Porter, H. K., Inc., 401 Ashland St., Everett, Mass.

CUTTERS (Die Sinking & End Milling)

Brown & Sharpe Mfg. Co., Providence 1, R. I.
Scully-Jones & Co., 1901 S. Rockwell St., Chicago 8, Ill.
Tomkins-Johnson Co., The, Dept. S, 611 N. Mechanic St., Jackson, Mich.

CUTTERS (Thread Milling)

Detroit Tap & Tool Co., 8432 Butler St., Detroit 11, Mich.
Plan-O-Mill Corp., 1511 E. Eight Mile Rd., Hazel Park, Mich.

CUTTERS (Wire and Cable)

Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Lewthwaite, T. H., Machine Co., Inc., 311 E. 47th St., New York 17, N. Y.
Porter, H. K., Inc., 401 Ashland St., Everett, Mass.

CUTTING AND WELDING—See WELDING

CUTTING OILS—See OILS (Cutting)

CUTTING-OFF MACHINES (Abrasive)

Bridgeport Safety Emery Wheel Co., Inc., The, P. O. Box 2031 Stratford, Bridgeport, Conn.
Campbell, Andrew C., Div., American Chain & Cable Co., Inc., Bridgeport 2, Conn.
Delta Mfg. Co., The, 703N E. Vienna Ave., Milwaukee 1, Wis.
deSanno, A. P., & Son Inc., 436 Wheatland St., Phoenixville, Pa.
Landis Machine Co., Waynesboro, Pa.

CUTTING-OFF MACHINES (Rotary)

Consolidated Machine Tool Corp. 565 Blossom Rd., Rochester 10, N. Y.
Pines Engineering Co., 600 Prairie St., Aurora, Ill.
Taylor-Wilson Mfg. Co., 15 Thomson Ave., McKees Rocks, Pa.
Yoder Co., The, 5500 Walworth Ave., Cleveland 2, O.

CYANIDING

Commercial Metals Treating, Inc. 177 S. St. Clair St., Toledo 1, O
Lakeside Steel Improvement Co., The, 5418 Lakeside Ave., Cleveland 14, O.
Pittsburgh Commercial Heat Treating Co., 49th St., & A.V.R.R., Pittsburgh 1, Pa.
U. S. Automatic Corp., Amherst, O.

CYLINDERS (Air or Hydraulic)

Anker-Holth Mfg. Co., 332 S. Michigan Ave., Chicago 4, Ill.
Curtis Pneumatic Machinery Div. of Curtis Mfg. Co., 1996 Kienlen Ave., St. Louis 20, Mo.
Denison Engineering Co., The, 1163 Dublin Rd., Columbus 16, O.
Galland-Henning Mfg. Co., 2747 S 31st St., Milwaukee 7, Wis.
Hanna Engineering Works, 1765 Elston Ave., Chicago 22, Ill.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago 24, Ill.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
Pesco Products Co., 11610 Euclid Ave., Cleveland 6, O.
Scaife Co., Ann St., Oakmont, Pa.
Tomkins-Johnson Co., The, Dept. S, 611 N. Mechanic St., Jackson, Mich.
Weatherhead Co., The, 300 E. 131st St., Cleveland 8, O

CYLINDERS (Pressure)

Bethlehem Steel Co., Bethlehem, Pa.
Harrisburg Steel Corp., Harrisburg, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
Midvale Co., The, Nicetown, Philadelphia 40, Pa.
National Tube Co., Frick Bldg., Pittsburgh 30, Pa.
Scaife Co., Ann St., Oakmont, Pa.
Taylor-Wharton Iron & Steel Co., Easton, Pa.

DEGREASERS

American Chemical Paint Co., Ambler, Pa.
Kelite Products Inc., 909 E. 60th St., Los Angeles 1, Cal.
Oakite Products, Inc., 34E Thames St., New York 6, N. Y.
Pennsylvania Salt Mfg. Co. Dept. S, Pennsalt Cleaner Div., Philadelphia 7, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Siefen, J. J., Co., 5657 Lauderdale Ave., Detroit 9, Mich.
Turco Products, Inc., 6135 S. Central Ave., Los Angeles 54, Cal.

DEODORANT (Plant Sanitation)

Kelite Products Inc., 909 E. 60th St., Los Angeles 1, Cal.
Oakite Products Inc., 34E Thames St., New York 6, N. Y.
Turco Products, Inc., 6135 S. Central Ave., Los Angeles 54, Cal.

DEOXIDIZERS

Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.

DESCALING PROCESSES AND EQUIPMENT

Ajax Electric Co., Inc., 911 Frankford Ave., Philadelphia 23, Pa.
American Chemical Paint Co., Ambler, Pa.
American Foundry Equipment Co., 509 S. Byrkit St., Mishawaka, Ind.
Bullard Co., The, Bridgeport 2, Conn.
Holden, A. F., Co., The, P. O. Box 1898, New Haven 8, Conn.
Kelite Products Inc., 909 E. 60th St., Los Angeles 1, Cal.
Linde Air Products Co., The, 30 E. 42nd St., New York 17, N. Y.
Oakite Products Inc., 34E Thames St., New York 6, N. Y.
Turco Products, Inc., 6135 S. Central Ave., Los Angeles 54, Cal.

DIAMOND POWDER

Industrial Abrasives, Inc., 3724 W. 38th St., Dept. 3-N, Chicago 32, Ill.
Smit, J. K., & Sons, Inc., 157 Chambers St., New York 7, N. Y.

DIAMOND TOOLS (Wheel Dressing)

Smit, J. K., & Sons, Inc., 157 Chambers St., New York 7, N. Y.

DIAMOND WHEELS

Industrial Abrasives, Inc., 3724 W. 38th St., Dept. 3-N, Chicago 32, Ill.
Smit, J. K., & Sons, Inc., 157 Chambers St., New York 7, N. Y.

DIAMONDS (Wheel Dressing)

Diamond Tool Co., 933 E. 41st St., Chicago 15, Ill.

DIE BLOCKS

Advance Foundry Co., The, 100 Parnell Ave., Dayton 3, O.
American Shear Knife Co., P.O. Box 355, Homestead, Pa
Ampco Metal Inc., Dept. S-11, Milwaukee 4, Wis.
Bissett Steel Co., The, 945 E. 67th St., Cleveland 8, O.
Finkl, A., & Sons Co., 2011 N. Southport Ave., Chicago 14, Ill.
Firth-Sterling Steel Company, McKeesport, Pa.
Heppenstall Co., Dept. TP, 4620 Hatfield St., Pittsburgh 1, Pa.
Holliday, W. J., & Co., Hammond, Ind.
Jessop Steel Co., 584 Green St., Washington, Pa.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago 50, Ill.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Pittsburgh Steel Foundry Corp., Glassport, Pa.
Standard Steel Works Div. of The Baldwin Locomotive Works. Philadelphia 42, Pa.

DIE CASTINGS (Aluminum, Zinc)

Advance Pressure Castings Inc., 894 Manhattan Ave., Brooklyn 24, N. Y.

DIE CENTERS

Firth-Sterling Steel Company, McKeesport, Pa.
Kennametal, Inc., 200 Lloyd Ave., Latrobe, Pa.
Vascoloy-Ramet Corp., N. Chicago, Ill.

DIE HEADS

Consolidated Machine Tool Corp., 565 Blossom Rd., Rochester 10, N. Y.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Murchey Machine & Tool Co., 951 Porter St., Detroit 26, Mich.
National Acme Co., The, 170 E. 131st St., Cleveland 8, O.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland 3, O.

DIE SETS

Advance Foundry Co., The, 100 Parnell Ave., Dayton 3, O.
Danly Machine Specialties, Inc., 2100 S. 52nd Ave., Chicago 50, Ill.

DIE-SINKING MACHINES

Cincinnati Milling Machine Co., Cincinnati 9, O.

DIES (Forging)—See FORGING DIES

DIES (Notching)

Lewthwaite, T. H., Machine Co., Inc., 311 E. 47th St., New York 17, N. Y.
Wales Strippit Corp., 385 Payne Ave., N. Tonawanda, N. Y.

DIES (Perforating)

Lewthwaite, T. H., Machine Co., Inc., 311 E. 47th St., New York 17, N. Y.
Wales Strippit Corp., 385 Payne Ave., N. Tonawanda, N. Y.

DIES (Punching, Stamping, Blanking)

Ace Mfg. Corp., 1211 East Erie Ave., Philadelphia 24, Pa.
Acme Pattern & Tool Co., Inc., 232 Findlay St., Dayton 3, O.
Advance Foundry Co., The, 100 Parnell Ave., Dayton 3, O.
Columbus Die, Tool & Mach. Co., The, 955 Cleveland Ave., Columbus 16, O.
Firth-Sterling Steel Company, McKeesport, Pa.
Lewthwaite, T. H., Machine Co., Inc., 311 E. 47th St., New York 17, N. Y.
Master Gauge Co., 2208 Fenkell Ave., Detroit 21, Mich.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo 11, N. Y.
Sheffield Corp., The, 721 Springfield St., Dayton 1, O.
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh 23, Pa.
Vascoloy-Ramet Corp., N. Chicago, Ill.
Wales Strippit Corp., 385 Payne Ave., N. Tonawanda, N. Y.
Zeh & Hahnemann Co., 56 Avenue A, Newark 5, N. J.

DIES (Steel, Embossing)

Cunningham, M. E., Co., 172 E. Carson St., Pittsburgh 19, Pa.
Matthews, Jas. H., & Co., 3978 Forbes St., Pittsburgh 13, Pa.

DIES AND CHASERS (Threading)

Landis Machine Co., Waynesboro, Pa.

DIFFERENTIALS

Fairfield Manufacturing Co., 303 S. Earl Ave., Lafayette, Ind.

DIPPERS (Rubber)

Goodrich, B. F., Co., The, Akron, O.

DIPPING MACHINES (Monorail)

American MonoRail Co., The, 13102 Athens Ave., Cleveland, O.
Cleveland Crane & Engineering Co., The, 1125 E. 283rd St., Wickliffe, O.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

DISCS (Abrasive)

Abrasive Products Inc., 511 Pearl St., S. Braintree, Mass.
Carborundum Co., The, Niagara Falls, N. Y.
Chicago Wheel & Manufacturing Co. Dept. ST, 1101 W. Monroe St., Chicago 7, Ill.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd. Chicago 6, Ill.
Minnesota Mining & Mfg. Co., 900 Fauquier St., St. Paul 6, Minn.

DOLOMITE—FLUX AND REFRACTORIES

Baker, The J. E., Co., 114 N. George St., York, Pa.
Basic Refractories, Inc., Hanna Bldg., Cleveland 15, O.

DOORS & SHUTTERS (Steel, Wood Rolling—Service, Fire)

Kinnear Mfg. Co., The, 1780-1800 Fields Ave., Columbus 16, O.
Mahon, R. C., Co., The, 8650 Mt. Elliott Ave., Detroit 11, Mich.

DOWEL PINS (Steel)

Danly Machine Specialties, Inc., 2100 S. 52nd Ave., Chicago 50, Ill.

DRAFT GAGES (Indicating, Recording)

Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.

DRAGLINES (Crawler)

Northwest Engineering Co., 28 E. Jackson Blvd., Chicago 4, Ill.

DRAW BENCHES

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown 1, O.
McKay Machine Co., The, Youngstown 2, O.
Vaughn Machinery Co., Cuyahoga Falls, O.

DRESSERS (Grinding Wheel)

Carborundum Co., The, Niagara Falls, N. Y.
Chicago Wheel & Manufacturing Co., Dept. ST, 1101 W. Monroe St., Chicago 7, Ill.
Diamond Tool Co., 933 E. 41st St., Chicago 15, Ill.
Lee, K. O., Company, Aberdeen, S. Dak.
Siefen, J. J., Co., 5657 Lauderdale Ave., Detroit 9, Mich.

DRILL HEADS

Cross Co., The, 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit 6, Mich.
Snyder Tool & Engineering Co., 3400 W. Lafayette Ave., Detroit 7, Mich.

DRILL RODS—See RODS (Drill)

DRILLING MACHINERY

Baker Bros., Inc., Post & Westlake Sts., Toledo 10, O.
Buffalo Forge Co., 158 Mortimer St., Buffalo 5, N. Y.
Cross Co., The 3250 Bellevue Ave., Detroit 7, Mich.
Delta Mfg. Co., The, 703N E. Vienna Ave., Milwaukee 1, Wis.
Dumore Co., The, 1225 14th St., Racine, Wis.
Snyder Tool & Engineering Co., 3400 E. Lafayette Ave., Detroit 7, Mich.

DRILLING MACHINES (Horizontal)

Snyder Tool & Engineering Co., 3400 E. Lafayette Ave., Detroit 7, Mich.

DRILLING MACHINES (Radial)

Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland 14, O.
Walker-Turner Co., Inc., 50123 Berckman St., Plainfield, N. J.

DRILLING MACHINES (Vertical)

Baker Bros., Inc., Post & Westlake Sts., Toledo 10, O.
Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago 6, Ill.
Cleereman Machine Tool Co., Green Bay, Wis.
Consolidated Machine Tool Corp., 565 Blossom Rd., Rochester 10, N. Y.
Cross Co., The, 3250 Bellevue Ave., Detroit 7, Mich.
Delta Mfg. Co., The, 703N E. Vienna Ave., Milwaukee 1, Wis.
Dumore Co., The, 1225 14th St., Racine, Wis.
Snyder Tool & Engineering Co., 3400 E. Lafayette Ave., Detroit 7, Mich.
Walker-Turner Co., Inc., 50123 Berckman St., Plainfield, N. J.

DRILLS (Electric Portable)

Chicago Wheel & Manufacturing Co., Dept. ST, 1101 W. Monroe St., Chicago 7, Ill.
Dumore Co., The, 1225 14th St., Racine, Wis.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago 6, Ill.
Mid-States Equipment Co., Welding Div., 2425 S. Michigan Ave., Chicago 16, Ill.
Syntron Co., 370 Lexington Ave., Homer City, Pa.

DRILLS (For Hardening Steels)

Black Drill Co., 1400 E. 222nd St., Cleveland 17, O.

DRILLS (Pneumatic)

Cleveland Pneumatic Tool Co., The, 3781 E. 77th St., Cleveland 5, O.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago 6, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

DRILLS (Twist)—See TWIST DRILLS

DRIVES (Chain)

Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Simonds Gear & Mfg. Co., The, 25th St., Pittsburgh 22, Pa.
Union Chain & Mfg. Co., Sandusky, O.

DRIVES (Cut Herringbone Gear)

Farrel-Birmingham Co., Inc., Ansonia, Conn.
Foote Bros. Gear & Machine Co., 5225 S. Western Blvd., Chicago 9, Ill.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland 14, O.
James, D. O., Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh 30, Pa.
Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia 40, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh 3, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
Philadelphia Gear Works, Erie Ave. & G Sts., Philadelphia 34, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh 22, Pa.
Westinghouse Electric & Mfg. Co., 200 McCandless Ave., Pittsburgh 1, Pa.

DRIVES (Hydraulic)

Twin Disc Clutch Co., 1379 Racine Ave., Racine, Wis.

DRIVES (Multi-V-Belt)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Dodge Manufacturing Corp., Mishawaka, Ind.
Medart Co., The, 3500 DeKalb St., St. Louis 18, Mo.

DRUMS (Steel)

Rheem Research Products, Inc., 2523 Pennsylvania Ave. Baltimore 17, Md.

DRYERS (Compressed Air)

Ruemelin Mfg. Co., 3882 N. Palmer St., Milwaukee 12, Wis.
Sturtevant, B. F., Co., Hyde Park, Boston 36, Mass.

DRYERS (Paint, Varnish, Enamel, Chemical)

Blaw-Knox Div. of Blaw-Knox Co., Blawnox, Pa.
Despatch Oven Co., 619 Eighth St., S.E., Minneapolis 14, Minn.
Fostoria Pressed Steel Corp., The, Fostoria, O.
Industrial Oven Engineering Co., The, 11621 Detroit Ave., Cleveland 2, O.
Hall, C. M., Lamp Co., 1005 E. Hancock St., Detroit 7, Mich.
Maehler, Paul, Co., The, 2208 W. Lake St., Chicago 12, Ill.
Mahon, The R. C., Co., 8650 Mt. Elliott Ave., Detroit 11, Mich.
Struthers Wells Corp., Titusville, Pa
Wagner Litho Machinery Co., Hoboken, N. J.

DRYERS AND COOLERS (Rotary)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Industrial Oven Engineering Co., The, 11621 Detroit Ave., Cleveland 2, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Vulcan Iron Works, Wilkes-Barre, Pa.

DUCTS (Acid Fume, Rubber Lined)

Johns-Manville Corp., 22 E. 40th St., New York 16, N. Y.

DUST ARRESTING EQUIPMENT

American Air Filter Co., Inc., 443 Central Ave., Louisville 8, Ky.
American Foundry Equipment Co., 509 S. Byrkit St., Mishawaka, Ind.
Brandt, Charles T., Inc., 1702 Ridgely St., Baltimore 30, Md.
Mahon, R. C., Co., The, 8650 Mt. Elliott Ave., Detroit 11, Mich.
Pangborn Corporation, Hagerstown, Md.
Ruemelin Mfg. Co., 3882 N. Palmer St., Milwaukee 12, Wis.
Schneible, Claude B., Co., 2827 25th St., Detroit 16, Mich.
Sturtevant, B. F., Co., Hyde Park, Boston 36, Mass.
Westinghouse Electric & Mfg Co., 1216 W. 58th St., Cleveland 1, O.

ECONOMIZERS

Babcock & Wilcox Co., The, 85 Liberty St., New York 6, N. Y.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Sturtevant, B. F., Co., Hyde Park, Boston 36, Mass.

ELECTRICAL EQUIPMENT

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Anaconda Wire & Cable Co., 25 Broadway, New York 4, N. Y.
Clark Controller Co., The, 1146 E. 152nd St., Cleveland 10, O.
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee 1, Wis.
Dumore Co., The, 1225 14th St., Racine, Wis.
Electric Controller & Mfg. Co., The, 2698 E. 79th St., Cleveland 4, O.
Electric Eye Equipment Co., 11 W. Fairchild St., Danville, Ill.
Fairbanks, Morse & Co., Fairbanks-Morse Bldg., Chicago 5, Ill.
Federal Telephone & Radio Corp., Div. International Telephone & Telegraph Corp., 32 Central Ave., Newark 1, N. J.
Fostoria Pressed Steel Corp., The, Fostoria, O.
General Electric Co., Schenectady 5, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Master Electric Co., The, 100 Davis Ave., Dayton 1, O.
Square D Co., 6060 Rivard St., Detroit 11, Mich.
Sturtevant, B. F., Co., Hyde Park, Boston 36, Mass.
Ward Leonard Electric Co., 65 South St., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

ELECTRODES (Alloy) (*Also Stainless)

Air Reduction, 60 E. 42nd St., New York 17, N. Y.
*Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
*Alloy Rods Co., York, Pa.
*Eutectic Welding Alloys Co., 40 Worth St., New York 13, N. Y.
*General Electric Co., Schenectady 5, N. Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
*The McKay Co., York, Pa.
Victor Equipment Co., 844-54 Folsom St., San Francisco 7, Cal.

ELECTRODES (Carbon and Graphite)

National Carbon Co., Inc., Electrode Sales Div., 30 E. 42nd St., New York 17, N. Y.

ELECTRODES (Hard Surfacing Welding)

Air Reduction, 60 E. 42nd St., New York 17, N. Y.
General Electric Co., Schenectady 5, N. Y.
Lee, K. O., Company, Aberdeen, S. Dak.
Lincoln Electric Co., The, Cleveland 1, O.
Metal & Thermit Corp., 120 Broadway, New York 5, N. Y.
Page Steel & Wire Div., American Chain & Cable Co., Inc., Monessen, Pa.
United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.
Victor Equipment Co., 844-54 Folsom St., San Francisco 7, Cal.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

ELECTRODES (Resistance Welding)

Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.
National Carbon Co., Inc., 30 E. 42nd St., New York 17, N. Y.
Victor Equipment Co., 844-54 Folsom St., San Francisco 7, Cal.

ELEVATING AND CONVEYING MACHINERY—See CONVEYORS

ELEVATORS

Otis Elevator Co., 260 11th Ave., New York 1, N. Y.

ENGINEERS AND CONTRACTORS

Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland 10, O.
Brandt, Charles T., Inc., 1702 Ridgely St., Baltimore 30, Md.
Eichleay Engineering Corp., 33 S. 19th St., Pittsburgh 3, Pa.
Hydropress, Inc., 570 Lexington Ave., New York 22, N. Y.
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland 1, O.
Mahon, R. C., Co., The, 8650 Mt. Elliott Ave., Detroit 11, Mich.
Mississippi Valley Structural Steel Co., St. Louis, Mo.
Morgan Engineering Co., The, Alliance, O.
Wean Engineering Co. Inc., The, Warren, O.

ENGINEERS (Consulting)

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown 1, O.
Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh 22, Pa.
Easton Car & Construction Co., Easton, Pa.
Garrett, George K., Co., 1421 Chestnut St., Philadelphia 2, Pa.
Koppers Co., Engineering and Construction Div., 300 Koppers Bldg., Pittsburgh 19, Pa.
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland 1, O.
Rheem Research Products, Inc., 2523 Pennsylvania Ave., Baltimore 17, Md.
Trundle Engineering Co., The, 1501 Euclid Ave., Cleveland 15, O.

ENGINEERS (Management)

Trundle Engineering Co., The, 1501 Euclid Ave., Cleveland 15, O.

ENGINES (Diesel)

Cooper-Bessemer Corp., The, Mt. Vernon, O.
Fairbanks, Morse & Co., Fairbanks-Morse Bldg., Chicago 5, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

ENGINES (Gas, Oil)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Cooper-Bessemer Corp., The, Mt. Vernon, O.
Fairbanks, Morse & Co., Fairbanks-Morse Bldg., Chicago 5, Ill.
Ingersoll-Rand Co., 11 Broadway New York 4, N. Y.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
Wisconsin Motor Corp., Milwaukee 14, Wis.

ENGINES (Kerosene)

Fairbanks, Morse & Co., Fairbanks-Morse Bldg., Chicago 5, Ill.

ENGINES (Steam)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
Oil Well Supply Co., Dallas 1, Tex.
Sturtevant, B. F., Co., Hyde Park, Boston 36, Mass.
Vulcan Iron Works, Wilkes-Barre, Pa.

EVAPORATORS

Blaw-Knox Div. of Blaw-Knox Co., Blawnox, Pa.
Struthers Wells Corp., Titusville, Pa.

EXCAVATORS

Northwest Engineering Co., 28 E. Jackson Blvd., Chicago 4, Ill.
Osgood Co., The, Marion, O.

EXHAUST HEADS

Burt Mfg. Company, The, 400 S. High St., Akron 11, O.

FABRICATORS (Structural)

Bethlehem Steel Co., Bethlehem, Pa.
Blaw-Knox Div. of Blaw-Knox Co., Blawnox, Pa.

FABRICATORS (Structural) (Con.)

Consolidated Steel Corp., Ltd., 5700 S. Eastern Ave., Los Angeles 22, Cal.
Danly Machine Specialties, Inc., 2100 S. 52nd Ave., Chicago 50, Ill.
Graver Tank & Mfg. Co., Inc., 4811-29 Tod Ave., E. Chicago, Ind.
Ingalls Iron Works Co., The, Birmingham 2, Ala.
Mahon, R. C., Co., The, 8650 Mt. Elliott Ave., Detroit 11, Mich.
Mississippi Valley Structural Steel Co., Decatur, Ill.
Youngstown Welding & Eng. Co., The, 3711 Oakwood Ave., Youngstown 9, O.

FANS (Crane Cab)

American Blower Corp., 8111 Tireman Ave., Detroit 4, Mich.
Perkins, B. F., & Son, Inc., Holyoke, Mass.

FANS (Exhaust Ventilating)

American Blower Corp., 8111 Tireman Ave., Detroit 4, Mich.
Buffalo Forge Co., 158 Mortimer St., Buffalo 5, N. Y.
General Electric Co., Sec. A-443-90 Tungar & Metallic Rectifier Div., Bridgeport 2, Conn.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Sturtevant, B. F., Co., Hyde Park, Boston 36, Mass.

FANS (Mechanical Draft)

American Blower Corp., 8111 Tireman Ave., Detroit 4, Mich.
Buffalo Forge Co., 158 Mortimer St., Buffalo 5, N. Y.
Despatch Oven Co., 619 Eighth St., S.E., Minneapolis 14, Minn.
Sturtevant, B. F., Co., Hyde Park, Boston 36, Mass.

FANS (Portable)

Buffalo Forge Co., 158 Mortimer St., Buffalo 5, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Perkins, B. F., & Son, Inc., Holyoke, Mass.

FANS (Wall)

Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Perkins, B. F., & Son, Inc., Holyoke, Mass.

FASTENERS (Locked In)

Bardwell & McAlister, Inc., P. O. Box 1310, Hollywood 28, Cal.

FEEDERS (Rotary)

Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh 22, Pa.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.

FEEDS (Roll, Dial, Magazine)

Littell, F. J., Machine Co., 4165 N. Ravenswood Ave., Chicago 13, Ill.

FENCE (Chain Link)

Continental Steel Corp., Kokomo, Ind.
Cyclone Fence Div., American Steel & Wire Co., Waukegan, Ill.
Levinson Steel Sales Co., The, 33 Pride St., Pittsburgh 19, Pa.
Page Steel & Wire Div. American Chain & Cable Co., Inc., Monessen, Pa.
Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh 30, Pa.

FENCE POSTS (Steel)

Bethlehem Steel Co., Bethlehem, Pa.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.

FENCING (Wire)

American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco 6, Cal.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Keystone Steel & Wire Co., Peoria 7, Ill.
Page Steel & Wire Div. American Chain & Cable Co., Inc., Monessen, Pa.
Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh 30, Pa.
Republic Steel Corp., Dept. ST., Cleveland 4, O.
Roebling's, John A., Sons Co., Trenton 2, N. J.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham 2, Ala.

FERROALLOY BRIQUETS

Electro Metallurgical Co., 30 E. 42nd St., New York 17, N. Y.

FERROALLOYS

Cleveland-Cliffs Iron Co., The, Union Commerce Bldg., Cleveland 14, O.
Electro Metallurgical Co., 30 E. 42nd St., New York 17, N. Y.
International Nickel Co., Inc., The, 67 Wall St., New York 5, N. Y.
Metal & Thermit Corp., 120 Broadway, New York 5, N. Y.

FERROBORON

Electro Metallurgical Co., 30 E. 42nd St., New York 17, N. Y.
Molybdenum Corp. of America, Grant Bldg., Pittsburgh 19, Pa.

FERROCOLUMBIUM

Electro Metallurgical Co., 30 E. 42nd St., New York 17, N. Y.

FERROCHROME

Electro Metallurgical Co., 30 E. 42nd St., New York 17, N. Y.
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia 2, Pa.

FERROMANGANESE

Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Electro Metallurgical Co., 30 E. 42nd St., New York 17, N. Y.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia 2, Pa.

FERROMOLYBDENUM

Climax Molybdenum Co., 500 Fifth Ave., New York 18, N. Y.
Molybdenum Corp. of America, Grant Bldg., Pittsburgh 19, Pa.

FERROPHOSPHORUS

Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia 2, Pa.

FERROSILICON

Electro Metallurgical Co., 30 E. 42nd St., New York 17, N. Y.
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia 2, Pa.
Southern Ferro Alloys Co., 2108 Chestnut St., Chattanooga 2, Tenn.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

FERROTITANIUM

Metal & Thermit Corp., 120 Broadway, New York 5, N. Y.

FERROTUNGSTEN

Electro Metallurgical Co., 30 E. 42nd St., New York 17, N. Y.
Molybdenum Corp. of America, Grant Bldg., Pittsburgh 19, Pa.

FERROVANADIUM

Electro Metallurgical Sales Corp., 30 E. 42nd St., New York 17, N. Y.

FILES AND RASPS

Disston, Henry, & Sons, Inc., 526 Tacony, Philadelphia 35, Pa.
Simonds Saw & Steel Co., 1350 Columbia Rd., Boston 27, Mass.

FILES (Band-Metal)

DoAll Co., The, 231 N. Laurel Ave., Des Plaines, Ill.

FILTER MEDIA

Moraine Products Div., General Motors Corp., Dayton 1, O.

FILTERS (Air)—See CLEANERS AND FILTERS (Air)

FILTERS (Acid)

Adams, R. P., Co., Inc., 75 Chicago St., Buffalo 4, N. Y.

FILTERS (Air-Engine)

American Air Filter Co., Inc., 443 Central Ave., Louisville 8, Ky.
Donaldson Co. Inc., 666 Pelham St., St. Paul 4, Minn.

FILTERS (Oil)

Burt Mfg. Company, The, 400 S. High St., Akron 11, O.

FINISH, BLACK OXIDE (Chemicals for)

Holden, A. F., Co., The, P. O. Box 1898, New Haven 8, Conn.

FINISHING EQUIPMENT (Painting, and Drying)

Fostoria Pressed Steel Corp., The, Fostoria, O.
Mahon, R. C., Co., The, 8650 Mt. Elliott Ave., Detroit 11, Mich.

FIRE BRICK—See BRICK

FIRE BRICK (Insulating)

Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York 6, N. Y.
Johns-Manville Corp., 22 E. 40th St., New York 16, N. Y.

FIRE CLAY —See REFRACTORIES

FIRE DOORS & SHUTTERS—See DOORS & SHUTTERS

FIRE EXTINGUISHERS

Cardox Corp., Bell Bldg., Chicago 1, Ill.
Kidde, Walter, & Co., Inc., 140 Cedar St., New York 6, N. Y.
Wahlert Products Corp., 27 Lafayette St., Brooklyn 1, N. Y.

FIRE EXTINGUISHING SYSTEMS

Cardox Corp., Bell Bldg., Chicago 1, Ill.
Kidde, Walter, & Co., Inc., 140 Cedar St., New York 6, N. Y.

FIRST AID EQUIPMENT

Wahlert Products Corp., 27 Lafayette St., Brooklyn 1, N. Y.

FITTINGS (Acid Proof)

Goodrich, B. F., Co., The, Akron, O.
United States Rubber Co., Mechanical Goods Div., 1230 Sixth Ave., New York 20, N. Y.

FITTINGS (Malleable and Cast Iron)

Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.

FLAME HARDENING

Air Reduction, 60 E. 42nd St., New York 17, N. Y.
American Welding & Mfg. Co., The, Warren, O.
Commercial Metals Treating, Inc., 177 S. St. Clair St., Toledo 1, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Kaydon Engineering Corp., The, McCracken St., Muskegon, Mich.
Lakeside Steel Improvement Co., The, 5418 Lakeside Ave., Cleveland 14, O.
Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.
Victor Equipment Co., 844-54 Folsom St., San Francisco 7, Cal.

FLANGES (Cast Steel)

Commercial Metals Treating, Inc., 177 S. St. Clair St., Toledo 1, O.
Pittsburgh Steel Foundry Corp., Glassport, Pa.

FLANGES (Forged Steel)

Bethlehem Steel Co., Bethlehem, Pa.
Commercial Metals Treating, Inc., 177 S. St. Clair St., Toledo 1, O.
Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
Harrisburg Steel Corp., Harrisburg, Pa.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago 50, Ill.
Ladish Drop Forge Co., Cudahy, Wis.
Phoenix Manufacturing Co., 332 S. Michigan Ave., Chicago 4, Ill.
Steel Improvement & Forge Co., The, 942 E. 64th St., Cleveland 14, O.
United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.

FLANGES (Welded Steel)

Graver Tank & Mfg. Co., Inc., 4811-29 Tod Ave., E. Chicago, Ind.
King Fifth Wheel Co., 2915 N. Second St., Philadelphia 33, Pa.

FLEXIBLE SHAFT MACHINERY

Walker-Turner Co., Inc., 50123 Berckman St., Plainfield, N. J.
Wyzenbeek & Staff Inc., 838 W. Hubbard St., Chicago 22, Ill.

FLOOD LIGHTS

Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.

FLOORING (Monolithic)

Johns-Manville Corp., 22 E. 40th St., New York 16, N. Y.

FLOORING (Steel)

Alan Wood Steel Co., Conshohocken, Pa.
Blaw-Knox Div. of Blaw-Knox Co., Blawnox, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Dravo Corp. (Machinery Div.), 300 Penn Ave., Pittsburgh 22, Pa.
Hendrick Mfg. Co., 37 Dundaff St., Carbondale, Pa.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
Levinson Steel Sales Co., The, 33 Pride St., Pittsburgh 19, Pa.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Tri-Lok Co., 5515 Butler St., Pittsburgh 1, Pa.
United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.

FLUE GAS ANALYZERS

Electric Eye Equipment Co., 11 W. Fairchild St., Danville, Ill.
Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia 44, Pa.

FLUORSPAR

Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia 2, Pa.
Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.

FLUXES (Brazing)

Handy & Harman, 82 Fulton St., New York 7, N. Y.
Krembs & Co., 666 W. Ohio St., Chicago 10, Ill.
Linde Air Products Co., The, 30 E. 42nd St., New York 17, N. Y.
Victor Equipment Co., 844-54 Folsom St., San Francisco 7, Cal.

FLUXES (Soldering, Welding & Tinning)

American Chemical Paint Co., Ambler, Pa.
Eutectic Welding Alloys Co., 40 Worth St., New York 13, N. Y.
Handy & Harman, 82 Fulton St., New York 7, N. Y.
Krembs & Co., 666 W. Ohio St., Chicago 10, Ill.
Johnson, Lloyd S., Co., 2241 S. Indiana Ave., Chicago 16, Ill.
Kelite Products Inc., 909 E. 60th St., Los Angeles 1, Cal.
Kester Solder Co., 4222 Wrightwood Ave., Chicago 39, Ill.
Linde Air Products Co., The, 30 E. 42nd St., New York 17, N. Y.
Victor Equipment Co., 844-54 Folsom St., San Francisco 7, Cal.

FORGING DIES

Finkl, A., & Sons Co., 2011 N. Southport Ave., Chicago 14, Ill.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago 50, Ill.
Phoenix Manufacturing Co., 332 S. Michigan Ave., Chicago 4, Ill.
Steel Improvement & Forge Co., The, 942 E. 64th St., Cleveland 14, O.

FORGING MACHINERY

Alliance Machine Co., The, Alliance, O.
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia 42, Pa.

FORGING MACHINERY (Con.)

Erie Foundry Co., Erie, Pa.
Hydraulic Press Mfg. Co., The, Mt. Gilead, O.
Industrial Brownhoist Corp., Bay City, Mich.
Morgan Engineering Co., The, Alliance, O.
National Machinery Co., The, Tiffin, O.
Pawtucket Mfg. Co., 327 Pine St., Pawtucket, R. I.

FORGINGS (Aluminum, Brass, Bronze, Copper)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
American Brass Co., The, Waterbury 88, Conn.
Ampco Metal Inc., Dept. S-11, Milwaukee 4, Wis.
Bison Forge Co., 119 Manitoba St., Buffalo 6, N. Y.
Bohn Aluminum & Brass Corp., Lafayette Bldg., Detroit 26, Mich.
Steel Improvement & Forge Co., The, 942 E. 64th St., Cleveland 14, O.
Titan Metal Mfg. Co., Bellefonte, Pa.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS (Drop) (*Also Stainless)

*Atlas Drop Forge Co., Lansing 2, Mich.
*Bethlehem Steel Co., Bethlehem, Pa
Davenport-Besler Corp., Davenport, Iowa.
Harrisburg Steel Corp., Harrisburg, Pa.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago 50, Ill.
Ladish Drop Forge Co., Cudahy, Wis.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh 3, Pa.
Phoenix Manufacturing Co., 332 S. Michigan Ave., Chicago 4, Ill.
Steel Improvement & Forge Co., The, 942 E. 64th St., Cleveland 14, O.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS (Hollow Bored)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Atlas Drop Forge Co., Lansing 2, Mich.
Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Commercial Forgings Co., The, 3700 E. 91st St., Cleveland 5, O.
Dresser Mfg. Co., Bradford, Pa.
Finkl, A., & Sons Co., 2011 N. Southport Ave., Chicago 14, Ill.
Harrisburg Steel Corp., Harrisburg, Pa.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago 50, Ill.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
Midvale Co., The, Nicetown, Philadelphia 40, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Phoenix Manufacturing Co., 332 S. Michigan Ave., Chicago 4, Ill.
Steel Improvement & Forge Co., The, 942 E. 64th St., Cleveland 14, O.

FORGINGS (Iron and Steel) (*Also Stainless)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
*Atlas Drop Forge Co., Lansing 2, Mich.
Bay City Forge Co., W. 19th and Cranberry Sts., Erie, Pa.
*Bethlehem Steel Co., Bethlehem, Pa.
Bison Forge Co., 119 Manitoba St., Buffalo 6, N. Y.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Commercial Forgings Co., The, 3700 E. 91st St., Cleveland 5, O.
Dresser Mfg. Co., Bradford, Pa.
Finkl, A., & Sons Co., 2011 N. Southport Ave., Chicago 14, Ill.
Heppenstall Co., Dept. TP, 4620 Hatfield St., Pittsburgh 1, Pa.
*Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago 50, Ill.
Ladish Drop Forge Co., Cudahy, Wis.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
*Midvale Co., The, Nicetown, Philadelphia 40, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Oil Well Supply Co., Dallas 1, Tex.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh 3, Pa.
Phoenix Manufacturing Co., 332 S. Michigan Ave., Chicago 4, Ill.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia 42, Pa.
Steel Improvement & Forge Co., The, 942 E. 64th St., Cleveland 14, O.
Struthers Wells Corp., Titusville, Pa.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS (Machined)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Bethlehem Steel Co., Bethlehem, Pa.
Dresser Mfg. Co., Bradford, Pa.
Finkl, A., & Sons Co., 2011 N. Southport Ave., Chicago 14, Ill.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago 50, Ill.
Steel Improvement & Forge Co., The, 942 E. 64th St., Cleveland 14, O.

FORGINGS (Press)

Bethlehem Steel Co., Bethlehem, Pa.
Dresser Mfg. Co., Bradford, Pa.
Ladish Drop Forge Co., Cudahy, Wis.
Steel Improvement & Forge Co., The, 942 E. 64th St., Cleveland 14, O.

FORGINGS (Small)

Dresser Mfg. Co., Bradford, Pa.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago 50, Ill.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh 3, Pa.
Phoenix Manufacturing Co., 332 S. Michigan Ave., Chicago 4, Ill.
Steel Improvement & Forge Co., The, 942 E. 64th St., Cleveland 14, O.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS (Upset)

Atlas Drop Forge Co., Lansing 2, Mich.
Bethlehem Steel Co., Bethlehem, Pa.
Dresser Mfg. Co., Bradford, Pa.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago 50, Ill.
Ladish Drop Forge Co., Cudahy, Wis.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh 3, Pa.
Phoenix Manufacturing Co., 332 S. Michigan Ave., Chicago 4, Ill.
Standard Tube Co., The, 14600 Woodward Ave., Detroit 3, Mich.
Steel Improvement & Forge Co., The, 942 E. 64th St., Cleveland 14, O.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

FOUNDRY EQUIPMENT

Ajax Flexible Coupling Co., 4 English St., Westfield, N. Y.
American Foundry Equipment Co., 509 S. Byrkit St., Mishawaka, Ind.
Buffalo Wire Works Co., Inc., 437 Terrace Rd., Buffalo 2, N. Y.
Delta Mfg. Co., The, 703N E. Vienna Ave., Milwaukee 1, Wis.
Hall, C. M., Lamp Co., 1005 E. Hancock St., Detroit 7, Mich.
Industrial Oven Engineering Co., The, 11621 Detroit Ave., Cleveland 2, O.
Jeffrey Mfg. Co., The, 889-99 N. Fourth St., Columbus 16, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Mahon, R. C., Co., The, 8650 Mt. Elliott Ave., Detroit 11, Mich.
Pangborn Corporation, Hagerstown, Md.
Ransohoff, N., Inc., 1317 Township Ave., Cincinnati 16, O.

FROGS AND SWITCHES

Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland 10, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Taylor-Wharton Iron & Steel Co., Easton, Pa.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

FURNACE EQUIPMENT (Water Cooled)

Blaw-Knox Div. of Blaw-Knox Co., Blawnox, Pa.

FURNACE INSULATION—See INSULATION

FURNACES (Brazing)

Ajax Electric Co., Inc., 911 Frankford Ave., Philadelphia 23, Pa.
Ajax Electrothermic Corp., Ajax Park, Trenton 5, N. J.
Cooley Electric Mfg. Corp., 38 S. Shelby St., Indianapolis 7, Ind.
Electric Furnace Co., The, 440 W. Wilson St., Salem, O.
Firth-Sterling Steel Co., McKeesport, Pa.
General Electric Co., Schenectady 5, N. Y.
Hevi Duty Electric Co., 4212 W. Highland Blvd., Milwaukee 1, Wis.
Holden, A. F., Co., The, P. O. Box 1898, New Haven 8, Conn.
Lepel High Frequency Laboratories, Inc., 39 W. 60th St., N.Y. 23, N.Y.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Tate-Jones & Co., Inc., Leetsdale, Pa.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

FURNACES (Controlled Atmosphere)

Bellevue Industrial Furnace Co., 2988 Bellevue Ave., Detroit 7, Mich.
Holcroft & Co., 6545 Epworth Blvd., Detroit 10, Mich.
Tate-Jones & Co., Inc., Leetsdale, Pa.

FURNACES (Electric Heating)

Ajax Electric Co., Inc., 911 Frankford Ave., Philadelphia 23, Pa.
Ajax Electrothermic Corp., Ajax Park, Trenton 5, N. J.
Cooley Electric Mfg. Corp., 38 S. Shelby St., Indianapolis 7, Ind.
Electric Furnace Co., The, 440 W. Wilson St., Salem, O.
General Electric Co., Schenectady 5, N. Y.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh 3, Pa.
Hevi Duty Electric Co., 4212 W. Highland Blvd., Milwaukee 1, Wis.
Holden, A. F., Co., The, P. O. Box 1898, New Haven 8, Conn.
Holcroft & Co., 6545 Epworth Blvd., Detroit 10, Mich.
Lepel High Frequency Laboratories, Inc., 39 W. 60th St., N.Y. 23, N.Y.
Pittsburgh Lectromelt Furnace Corp., P. O. Box 1257, Pittsburgh 30, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

FURNACES (Electric Melting)

Ajax Engineering Corp., P. O. Box 1418, Trenton 7, N. J.
Ajax Electrothermic Corp., Ajax Park, Trenton 5, N. J.
Ajax Electric Furnace Corp., 1108 Frankford Ave., Philadelphia 23, Pa.
American Bridge Co., Frick Bldg., Pittsburgh 19, Pa.
Detroit Electric Furnace Div., Kuhlman Electric Co., Bay City, Mich.
Lepel High Frequency Laboratories, Inc., 39 W. 60th St., N.Y. 23, N.Y.
Pittsburgh Lectromelt Furnace Corp., P. O. Box 1257, Pittsburgh 30, Pa.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh 30, Pa.

FURNACES (Enameling)

Cooley Electric Mfg. Corp., 38 S. Shelby St., Indianapolis 7, Ind.
Electric Furnace Co., The, 440 W. Wilson St., Salem, O.
General Electric Co., Schenectady 5, N. Y.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh 3, Pa.
Hall, C. M., Lamp Co., 1005 E. Hancock St., Detroit 7, Mich.
Industrial Oven Engineering Co., The, 11621 Detroit Ave., Cleveland 2, O.
Maehler, Paul, Co., The, 2208 W. Lake St., Chicago 12, Ill.

FURNACES (Forging)

Ajax Electric Co., Inc., 911 Frankford Ave., Philadelphia 23, Pa.
Ajax Electrothermic Corp., Ajax Park, Trenton 5, N. J.
Amsler-Morton Co., The, Fulton Bldg., Pittsburgh 22, Pa.
Electric Furnace Co., The, 440 W. Wilson St., Salem, O.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh 3, Pa.
Holcroft & Co., 6545 Epworth Blvd., Detroit 10, Mich.
Holden, A. F., Co., The, P. O. Box 1898, New Haven 8, Conn.
Industrial Oven Engineering Co., The, 11621 Detroit Ave., Cleveland 2, O.
Lepel High Frequency Laboratories, Inc., 39 W. 60th St., N.Y. 23, N.Y.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh 12, Pa.
R-S Products Corp., 122 Berkley St., Philadelphia 44, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Surface Combustion Div. of General Properties Co., Inc., 2375 Dorr St., Toledo 1, O.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh 30, Pa.
Tate-Jones & Co., Inc., Leetsdale, Pa.
Wilson, Lee, Engineering Co., Inc., 20005 Lake Rd., Cleveland 16, O.

FURNACES (Galvanizing)

Bellevue Industrial Furnace Co., 2988 Bellevue Ave., Detroit 7, Mich.
General Electric Co., Schenectady 5, N. Y.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh 12, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Tate-Jones & Co., Inc., Leetsdale, Pa

FURNACES (Gas or Oil)

Bellevue Industrial Furnace Co., 2988 Bellevue Ave., Detroit 7, Mich.
Electric Furnace Co., The, 440 W. Wilson St., Salem, O.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh 3, Pa.
Holcroft & Co., 6545 Epworth Blvd., Detroit 10, Mich.
Holden, A. F., Co., The, P. O. Box 1898, New Haven 8, Conn.
Industrial Oven Engineering Co., The, 11621 Detroit Ave., Cleveland 2, O.
Johnson Gas Appliance Co., 626 "E" Ave., N. W. Cedar Rapids, Iowa.
Loftus Engineering Corp., 1620 Oliver Bldg., Pittsburgh 22, Pa.
R-S Products Corp., 122 Berkley St., Philadelphia 44, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Surface Combustion Div. of General Properties Co., Inc., 2375 Dorr St., Toledo 1, O.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh 30, Pa.
Tate-Jones & Co., Inc., Leetsdale, Pa.

FURNACES (Heat Treating, Annealing, Carburizing, Hardening, Tempering)

Ajax Electric Co., Inc., 911 Frankford Ave., Philadelphia 23, Pa.
Ajax Electrothermic Corp., Ajax Park, Trenton 5, N. J.
Amsler-Morton Co., The, Fulton Bldg., Pittsburgh 22, Pa.
Bellevue Industrial Furnace Co., 2988 Bellevue Ave., Detroit 7, Mich.
Cooley Electric Mfg. Corp., 38 S. Shelby St., Indianapolis 7, Ind.
Despatch Oven Co., 619 Eighth St., S E., Minneapolis 14, Minn.
Electric Furnace Co., The, 440 W. Wilson St., Salem, O.
General Electric Co., Schenectady 5, N. Y.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh 3, Pa.
Hall, C. M., Lamp Co., 1005 E. Hancock St., Detroit 7, Mich.
Hevi Duty Electric Co., 4212 W. Highland Blvd., Milwaukee 1, Wis.
Holcroft & Co., 6545 Epworth Blvd., Detroit 10, Mich.
Holden, A. F., Co., The, P. O. Box 1898, New Haven 8, Conn.
Industrial Oven Engineering Co., The, 11621 Detroit Ave., Cleveland 2, O.
Johnson Gas Appliance Co., 626 "E" Ave., N. W., Cedar Rapids, Iowa.
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore 2, Md.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia 44, Pa.
Lepel High Frequency Laboratories, Inc., 39 W. 60th St., N.Y. 23, N.Y.
Loftus Engineering Corp., 1620 Oliver Bldg., Pittsburgh 22, Pa.

FURNACES (Heat Treating, Annealing, Carborizing, Hardening, Tempering) (Con.)

Maehler, Paul, Co., The, 2208 W. Lake St., Chicago 12, Ill.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh 12, Pa.
R-S Products Corp., 122 Berkley St., Philadelphia 44, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Surface Combustion Div. of General Properties Co., Inc., 2375 Dorr St., Toledo 1, O.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh 30, Pa.
Tate-Jones & Co., Inc., Leetsdale, Pa.
Wean Engineering Co., Inc., The, Warren, O.
Wellman Engineering Co., The, 7016 Central Ave., Cleveland 4, O.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.
Wilson, Lee, Engineering Co., Inc., 20005 Lake Rd., Cleveland 16, O.

FURNACES (Induction Melting)

Ajax Electric Furnace Corp., 1108 Frankford Ave., Philadelphia 23, Pa.
Ajax Electrothermic Corp., Ajax Park, Trenton 5, N. J.
Ajax Engineering Corp., P. O. Box 1418, Trenton 7, N. J.

FURNACES (Laboratory)

Ajax Electrothermic Corp., Ajax Park, Trenton 5, N. J.
Cooley Electric Mfg. Corp., 38 S. Shelby St., Indianapolis 7, Ind.
Despatch Oven Co., 619 Eighth St., S.E., Minneapolis 14, Minn.
Dietert, Harry W., Co., 9330 Roselawn Ave., Detroit 4, Mich.
Hall, C. M., Lamp Co., 1005 E. Hancock St., Detroit 7, Mich.
Hevi Duty Electric Co., 4212 W. Highland Blvd., Milwaukee 1, Wis.
Johnson Gas Appliance Co., 626 "E" Ave., N. W., Cedar Rapids, Iowa.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia 44, Pa.
Lepel High Frequency Laboratories, Inc., 39 W. 60th St., N.Y. 23, N.Y.
Tate-Jones & Co., Inc., Leetsdale, Pa.

FURNACES (Nonferrous Melting)

Ajax Electric Furnace Corp., 1108 Frankford Ave., Philadelphia 23, Pa.
Ajax Electrothermic Corp., Ajax Park, Trenton 5, N. J.
Ajax Engineering Corp., P. O. Box 1418, Trenton 7, N. J.
Bellevue Industrial Furnace Co., 2988 Bellevue Ave., Detroit 7, Mich.
Detroit Electric Furnace Div., Kuhlman Electric Co., Bay City, Mich.
Lepel High Frequency Laboratories, Inc., 39 W. 60th St., N.Y. 23, N.Y.
Loftus Engineering Corp., 1620 Oliver Bldg., Pittsburgh 22, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Tate-Jones & Co., Inc., Leetsdale, Pa.

FURNACES (Open Hearth)

Amsler-Morton Co., The, Fulton Bldg., Pittsburgh 22, Pa.
Blaw-Knox Div. of Blaw-Knox Co., Blawnox, Pa.
Loftus Engineering Corp., 1620 Oliver Bldg., Pittsburgh 22, Pa.
McKee, Arthur G., & Co., 2300 Chester Ave., Cleveland 1, O.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh 30, Pa.
Tate-Jones & Co., Inc., Leetsdale, Pa.
Wellman Engineering Co., 7016 Central Ave., Cleveland 4, O.

FURNACES (Pilot)

Cooley Electric Mfg. Corp., 38 S. Shelby St., Indianapolis 7, Ind.

FURNACES (Portable)

Bellevue Industrial Furnace Co., 2988 Bellevue Ave., Detroit 7, Mich.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh 3, Pa.
Hall, C. M., Lamp Co., 1005 E. Hancock St., Detroit 7, Mich.
Tate-Jones & Co., Inc., Leetsdale, Pa.

FURNACES (Recuperative)

Amsler-Morton Co., The, Fulton Bldg., Pittsburgh 22, Pa.
Bellevue Industrial Furnace Co., 2988 Bellevue Ave., Detroit 7, Mich.
Electric Furnace Co., The, 440 W. Wilson St., Salem, O.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh 3, Pa.
Industrial Oven Engineering Co., 11621 Detroit Ave., Cleveland 2, O.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Surface Combustion Div. of General Properties Co., Inc., 2375 Dorr St., Toledo 1, O.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh 30, Pa.
Tate-Jones & Co., Inc., Leetsdale, Pa.

FURNACES (Rivet Heating)

Ajax Electric Co., Inc., 911 Frankford Ave., Philadelphia 23, Pa.
Ajax Electrothermic Corp., Ajax Park, Trenton 5, N. J.
Lepel High Frequency Laboratories, Inc., 39 W. 60th St., N.Y. 23, N.Y.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Surface Combustion Div. of General Properties Co., Inc., 2375 Dorr St., Toledo 1, O.
Tate-Jones & Co., Inc., Leetsdale, Pa.

FURNACES (Sheet and Tin Mill)

Amsler-Morton Co., The, Fulton Bldg., Pittsburgh 22, Pa.
Bellevue Industrial Furnace Co., 2988 Bellevue Ave., Detroit 7, Mich.
Electric Furnace Co., The, 440 W. Wilson St., Salem, O.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh 3, Pa.
Hall, C. M., Lamp Co., 1005 E. Hancock St., Detroit 7, Mich.
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore 2, Md.
Loftus Engineering Corp., 1620 Oliver Bldg., Pittsburgh 22, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Surface Combustion Div. of General Properties Co., Inc., 2375 Dorr St., Toledo 1, O.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh 30, Pa.
Tate-Jones & Co., Inc., Leetsdale, Pa.
Wean Engineering Co., Inc., The, Warren, O.
Wilson, Lee, Engineering Co., Inc., 20005 Lake Rd., Cleveland 16, O.

FURNACES (Sintering)

Cooley Electric Mfg. Corp., 38 S. Shelby St., Indianapolis 7, Ind.

FURNACES (Steel Mill)

Amsler-Morton Co., The, Fulton Bldg., Pittsburgh 22, Pa.
Electric Furnace Co., The, 440 W. Wilson St., Salem, O.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh 3, Pa.
Holden, A. F., Co., The, P. O. Box 1898, New Haven 8, Conn.
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore 2, Md.
Loftus Engineering Corp., 1620 Oliver Bldg., Pittsburgh 22, Pa.
Pennsylvania Industrial Engineers, 2413 W. Magnolia St., Pittsburgh 12, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Surface Combustion Div. of General Properties Co., Inc., 2375 Dorr St., Toledo 1, O.
Swindell-Dressler Corp., P. O. Box 1888, Pittsburgh 30, Pa.
Tate-Jones & Co., Inc., Leetsdale, Pa.
Wean Engineering Co., Inc., The, Warren, O.
Wilson, Lee, Engineering Co., Inc., 20005 Lake Rd., Cleveland 16, O.

FURNACES (Welding)

Bellevue Industrial Furnace Co., 2988 Bellevue Ave., Detroit 7, Mich.
Despatch Oven Co., 619 Eighth St., S.E., Minneapolis 14, Minn.
Hagan, Geo. J., Co., 2400 E. Carson St., Pittsburgh 3, Pa.
Industrial Oven Engineering Co., The, 11621 Detroit Ave., Cleveland 2, O.

GAGE BLOCKS

Continental Machines, Inc., 1324 Washington Ave., Minneapolis 4, Minn.
Dearborn Gage Co., Dearborn, Mich.

GAGES

Ace Mfg. Co., 1211 E. Erie Ave., Philadelphia 24, Pa.
Brown & Sharpe Mfg. Co., Providence 1, R. I.
Electric Eye Equipment Co., 11 W. Fairchild St., Danville, Ill.
Firth-Sterling Steel Co., McKeesport, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Kennametal, Inc., 200 Lloyd Ave., Latrobe, Pa.
Master Gauge Co., 2208 Fenkell Ave., Detroit 21, Mich.
Scherr, George, Co., 202 Lafayette St., New York 12, N. Y.
Sheffield Corp., The, 721 Springfield St., Dayton 1, O.
Trico Products Corp., 43 Trico Square, Buffalo 3, N. Y.
Turner Gage Grinding Co., 2625 Hilton Rd., Ferndale, Mich.
Woodworth, N. A., Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

GAGES (Automatic Control & Recording)

Electric Eye Equipment Co., 11 W. Fairchild St., Danville, Ill.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia 44, Pa.
Sheffield Corp., The, 721 Springfield St., Dayton 1, O.

GAGES (Hard Faced)

Woodworth, N. A., Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

GAGES (Indicating and Recording)

Electric Eye Equipment Co., 11 W. Fairchild St., Danville, Ill.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
General Electric Co., Schenectady 5, N. Y.
Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia 44, Pa.
Sheffield Corp., The, 721 Springfield St., Dayton 1, O.
Westinghouse Electric & Mfg. Co., Orange Ave., Newark 1, N. J.

GAGES (Pressure & Vacuum Recording)

Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia 44, Pa.

GAGES (Thread-Ring & Plug)

Detroit Tap & Tool Co., 8432 Butler St., Detroit 11, Mich.
Electric Eye Equipment Co., 11 W. Fairchild St., Danville, Ill.
Sheffield Corp., The, 721 Springfield St., Dayton 1, O.
Turner Gage Grinding Co., 2625 Hilton Rd., Ferndale, Mich.

GALVANIZING (Electro)

Meaker Co., The, 1635 S. 55th Ave., Chicago 50, Ill.

GALVANIZING (Hot Dip)

Acme Galvanizing, Inc., Milwaukee 7, Wis.
Acme Steel & Malleable Iron Works, Buffalo, N. Y.
American Hot Dip Galvanizers Assoc., Inc., 1st National Bank Bldg., Pittsburgh 22, Pa.

GALVANIZING (Hot Dip)—Con.

American Tinning & Galvanizing Co., Erie, Pa.
Atlantic Stamping Co., Rochester, N. Y.
Atlantic Steel Co., Atlanta, Ga.
Atlas Galvanizing Inc., Los Angeles, Calif.
Buffalo Wire Works Co., Inc., 437 Terrace Rd., Buffalo 2, N. Y.
Cattie, Jos. P., & Bros., Gaul and Letterly Sts., Philadelphia 25, Pa.
Columbian Steel Tank Co., Kansas City 7, Mo.
Commercial Metals Treating, Inc., 177 S. St. Clair St., Toledo 1, O.
Diamond Expansion Bolt Co., Inc., Garwood, N. J.
Emsco Derrick & Equipment Co., Los Angeles 54, Calif.
Enterprise Galvanizing Co., 3525 E. Cumberland St., Philadelphia 25, Pa.
Equipment Steel Products Div. of Union Asbestos and Rubber Co., Blue Island, Ill.
Fanner Mfg. Co., The, Cleveland, O.
Finn, John, Metal Works, San Francisco 7, Cal.
Galvanizers Incorporated, Portland, Ore.
Gregory, Thomas, Galvanizing Works, Maspeth, N. Y.
Hanlon-Gregory Galvanizing Co., 5515 Butler St., Pittsburgh 1, Pa.
Hill, James, Mfg. Co., Providence, R. I.
Hubbard & Co., Oakland, Calif.
Independent Galvanizing Co., Newark, N. J.
International Derrick & Equipment Co., Torrance, Calif.
International-Stacey Corp., Columbus 8, O.
Isaacson Iron Works, Seattle 14, Wash.
Joslyn Co. of California, Los Angeles, Calif.
Joslyn Mfg. & Supply Co., Chicago 9, Ill.
Koven, L. O., & Bro., Inc., Jersey City, N. J.
Laughlin, Thomas, Co., Portland, Maine.
Lehigh Structural Steel Co., Allentown, Pa.
Lewis Bolt & Nut Co., Minneapolis, Minn.
Los Angeles Galvanizing Co., Huntington Park, Calif.
Missouri Rolling Mill Corp., St. Louis 10, Mo.
National Telephone Supply Co., The, Cleveland 3, O.
Newark Galvanizing Co., The, Newark, O.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh 3, Pa.
Penn Galvanizing Co., Philadelphia, Pa.
Rheem Research Products Inc., 2523 Pennsylvania Ave., Baltimore 17, Md.
Rheem Mfg. Co., Richmond, Calif.
Riverside Foundry & Galvanizing Co., Kalamazoo, Mich.
San Francisco Galvanizing Works, San Francisco, Calif.
Scaife Co., Ann St., Oakmont, Pa.
Southern Galvanizing Co., Baltimore 30, Md.
Standard Galvanizing Co., Chicago 18, Ill.
Superior Pacific Galvanizing Co., Los Angeles, Calif.
Western Galvanizing Co., Los Angeles 23, Calif.
Wilcox Crittenden & Co., Inc., Middletown, Conn.
Witt Cornice Co., The, Cincinnati 14, O.

GALVANIZING EQUIPMENT (Electro)

Meaker Co., The, 1635 S. 55th St., Chicago 50, Ill.

GALVANIZING PLANTS FOR SHEETS

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown 1, O.
Erie Foundry Co., Erie, Pa.
Wean Engineering Co., Inc., The, Warren, O.

GALVANIZING PRODUCTS

Commercial Metals Treating, Inc., 177 S. St. Clair St., Toledo 1, O.
Enterprise Galvanizing Co., 3525 E. Cumberland St., Philadelphia 25, Pa.

GAS HOLDERS

Bartlett-Hayward Div., Koppers Co., Baltimore 3, Md.
Bethlehem Steel Co., Bethlehem, Pa.

GAS PRODUCER PLANTS

Koppers Co., Engineering and Construction Div., 300 Koppers Bldg., Pittsburgh 19, Pa.
Morgan Construction Co., Worcester 5, Mass.
Wellman Engineering Co., The, 7016 Central Ave., Cleveland 4, O.
Wood, R. D., 400 Chestnut St., Philadelphia 5, Pa.

GAS RECOVERY COKE OVENS AND GAS PLANTS

Bartlett-Hayward Div., Koppers Co., Baltimore 3, Md.
Koppers Co., Engineering and Construction Div., 300 Koppers Bldg., Pittsburgh 19, Pa.

GAS SCRUBBERS AND WASHERS

Bartlett-Hayward Div., Koppers Co., Baltimore 3, Md.
Blaw-Knox Div. of Blaw-Knox Co., Blawnox, Pa.
Buffalo Forge Co., 158 Mortimer St., Buffalo 5, N. Y.

GASKETS (Asbestos, Metal or Rubber)

Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
Johns-Manville Corp., 22 E. 40th St., New York 16, N. Y.
National Lead Co., 111 Broadway, New York 6, N. Y.
Steel Improvement & Forge Co., The, 942 E. 64th St., Cleveland 14, O.

GATES (Iron & Steel)

Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Wire Works Co., Inc., 437 Terrace Rd., Buffalo 2, N. Y.

GEAR BLANKS

American Welding & Mfg. Co., The, Warren, O.
Ampco Metal Inc., Dept. S-11, Milwaukee 4, Wis.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Commercial Forgings Co., The, 3700 E. 91st St., Cleveland 5, O.
Dresser Mfg. Co., Bradford, Pa.
Finkl, A., & Sons Co., 2011 N. Southport Ave., Chicago 14, Ill.
Foote Bros. Gear & Machine Co., 5225 S. Western Blvd., Chicago 9, Ill.
King Fifth Wheel Co., 2915 N. Second St. Philadelphia 33, Pa.
Ladish Drop Forge Co., Cudahy, Wis.
Medart Co., The, 3500 DeKalb St., St. Louis 18, Mo.
Philadelphia Gear Works, Erie Ave. & G St., Philadelphia 34, Pa.
Pittsburgh Steel Foundry Corp., Glassport, Pa.
Shenango-Penn Mold Co., 444 W. Third St., Dover, O.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia 42, Pa.
Union Steel Casting Div., Blaw-Knox Co., 62nd & Butler Sts., Pittsburgh 1, Pa.
U. S. Automatic Corp., Amherst, O.
Waldron, John, Corp., New Brunswick, N. J.

GEAR MACHINERY (Generating)

Cross Co., The, 3250 Bellevue Ave., Detroit 7, Mich.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
National Broach & Machine Co., 5600 St. Jean, Detroit 13, Mich.

GEAR MACHINERY (Lapping, Finishing, Checking)

Farrel-Birmingham Co., Inc., Ansonia, Conn.
Cross Co., The, 3250 Bellevue Ave., Detroit 7, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Sheffield Corp., The, 721 Springfield St., Dayton 1, O.

GEARS (Nonmetallic)

Chicago Rawhide Mfg. Co., 1308 Elston Ave., Chicago 22, Ill.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
General Electric Co., Schenectady 5, N. Y.
Industrial Gear Mfg. Co., 4545 W. Van Buren St., Chicago 24, Ill.
James, D. O., Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Medart Co., The, 3500 DeKalb St., St. Louis 18, Mo.
Pittsburgh Gear & Machine Co., 2680-2700 Smallman St., Pittsburgh 22, Pa.
Simonds Gear & Mfg. Co., The, 25th St., Pittsburgh 22, Pa.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

GEARS (Steel Laminated)

Industrial Gear Mfg. Co., 4545 W. Van Buren St., Chicago 24, Ill.
Simonds Gear & Mfg. Co., The, 25th St., Pittsburgh 22, Pa.
Waldron, John, Corp., New Brunswick, N. J.

GEARS (Worm)

Cleveland Worm & Gear Co., The, 3270 E. 80th St., Cleveland 4, O.
Fairfield Manufacturing Co., 303 S. Earle Ave., Lafayette, Ind.
Foote Bros. Gear & Machine Co., 5225 S. Western Blvd., Chicago 9, Ill.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland 14, O.
Industrial Gear Mfg. Co., 4545 W. Van Buren St., Chicago 24, Ill.
James, D. O., Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Medart Co., The, 3500 DeKalb St., St. Louis 18, Mo.
Philadelphia Gear Works; Erie Ave. & G St., Philadelphia 34, Pa.
Pittsburgh Gear & Machine Co., 2680-2700 Smallman St., Pittsburgh 22, Pa.
Simonds Gear & Mfg. Co., The, 25th St., Pittsburgh 22, Pa.

GEARS AND GEAR CUTTING

Dodge Manufacturing Corp., Mishawaka, Ind.
Fairfield Manufacturing Co., 303 S. Earl Ave., Lafayette, Ind.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Foote, Brad, Gear Works, Cicero, Ill.
Foote Bros. Gear & Machine Co., 5225 S. Western Blvd., Chicago 9, Ill.
General Electric Co., Schenectady 5, N. Y.
Grant Gear Works, 2nd & B Sts., Boston 27, Mass.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland 14, O.
Industrial Gear Mfg. Co., 4545 W. Van Buren St., Chicago 24, Ill.
James, D. O., Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Jones, W. A., Fdry. & Mach. Co., 4437 Roosevelt Rd., Chicago 24, Ill.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh 30, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh 3, Pa.
Medart Co., The, 3500 DeKalb St., St. Louis 18, Mo.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Moraine Products Div., General Motors Corp., Dayton 1, O.
Philadelphia Gear Works, Erie Ave. & G St., Philadelphia 34, Pa.
Pittsburgh Gear & Machine Co., 2680-2700 Smallman St., Pittsburgh 22, Pa.
Simonds Gear & Mfg. Co., The, 25th St., Pittsburgh 22, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh 22, Pa.
Westinghouse Electric & Mfg. Co., 200 McCandless Ave., Pittsburgh 1, Pa.

GENERATING SETS

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Century Electric Co., 1806 Pine St., St. Louis 3, Mo.
Cooper-Bessemer Corp., The, Mt. Vernon, O.
Fairbanks, Morse & Co., Fairbanks-Morse Bldg., Chicago 5, Ill.
General Electric Co., Schenectady 5, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukeee 14, Wis.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Kato Engineering Co., Mankato, Minn.
Master Electric Co., The, 100 Davis Ave., Dayton 1, O.
Ready-Power Co., The, 3842 Grand River Ave., Detroit 8, Mich.
Reliance Electric & Eng. Co., 1088 Ivanhoe Rd., Cleveland 10, O.
Siefen, J. J., Co., 5657 Lauderdale Ave., Detroit 9, Mich.
Sturtevant, B. F., Co., Hyde Park, Boston 36, Mass.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

GENERATORS (Acetylene—Portable and Stationary)

Linde Air Products Co., The, 30 E. 42nd St., New York 17, N. Y.

GENERATORS (Electric)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Century Electric Co., 1806 Pine St., St. Louis 3, Mo.
Fairbanks, Morse & Co., Fairbanks-Morse Bldg., Chicago 5, Ill.
General Electric Co., Schenectady 5, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Kato Engineering Co., Mankato, Minn.
Lincoln Electric Co., The, Cleveland 1, O.
Master Electric Co., The, 100 Davis Ave., Dayton 1, O.
Reliance Electric & Eng. Co., 1088 Ivanhoe Rd., Cleveland 10, O.
Sturtevant, B. F., Co., Hyde Park, Boston 36, Mass.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

GENERATORS (Plating)

Meaker Co., The, 1635 S. 55th Ave., Chicago 50, Ill.
Udylite Corp., The, 1651 E. Grand Blvd., Detroit 11, Mich.

GLUE (Glue & Abrasive Mixed)

Siefen, J. J., Co., 5657 Lauderdale Ave., Detroit 9, Mich.

GLUE (Liquid Cold)

Siefen, J. J., Co., 5657 Lauderdale Ave., Detroit 9, Mich.

GRABS—FOR SHEETS, COILS, INGOTS

J-B Engineering Sales Co., 3101 East St., New Haven 3, Conn.

GRAPHITE

National Carbon Co., Inc., 30 E. 42nd St., New York 17, N. Y.

GRATING

Blaw-Knox Div. of Blaw-Knox Co., Blawnox, Pa.
Dravo Corp., (Machinery Div.) 300 Penn Ave., Pittsburgh 22, Pa.
Hendrick Mfg. Co., 37 Dundaff St. Carbondale, Pa.
Tri-Lok Co., 5515 Butler St., Pittsburgh 1, Pa.

GREASE (Lubricating)—See LUBRICANTS (Industrial)

GREASE SEALS

Chicago Rawhide Mfg. Co., 1308 Elston Ave., Chicago 22, Ill.
Michigan Leather Products Co., 6315 E. Lafayette Ave., Detroit 7, Mich.

GRILLS (Perforated Metal)

Buffalo Wire Works Co., Inc., 437 Terrace Rd., Buffalo 2, N. Y.
Diamond Mfg. Co., Wyoming, Pa.
Hendrick Mfg. Co., 37 Dundaff St. Carbondale, Pa.

GRINDER ATTACHMENTS

Brown & Sharpe Mfg. Co., Providence 1, R. I.
Cincinnati Grinders, Incorporated, Cincinnati 9, O.
Delta Mfg. Co., The, 703N E. Vienna Ave., Milwaukee 1, Wis.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Landis Machine Co., Waynesboro, Pa.
Lee, K. O., Company, Aberdeen, S. Dak.
Mercury Products Co., 423 Euclid Ave., Cleveland 14, O.

GRINDER CENTERS

Firth-Sterling Steel Company, McKeesport, Pa.
Kennametal, Inc., 200 Lloyd Ave., Latrobe, Pa.
Scully-Jones & Co., 1901 S. Rockwell St., Chicago 8, Ill.

GRINDER HEADS

Fitchburg Grinding Machine Corp., Fitchburg, Mass.

GRINDERS (Automotive Reconditioning)

Dumore Co., The, 1225 14th St., Racine, Wis.
Heald Machine Co., The, Worcester 6, Mass.

GRINDERS (Bench & Floor Type)

Bridgeport Safety Emery Wheel Co., Inc., The, P.O. Box 2031 Stratford, Bridgeport, Conn.
Delta Mfg. Co., The, 703N E. Vienna Ave., Milwaukee 1, Wis.
Dumore Co., The, 1225 14th St., Racine, Wis.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago 6, Ill.
Walker-Turner Co., Inc., 50123 Berckman St., Plainfield, N. J.

GRINDERS (Centerless—Internal and External)

Cincinnati Grinders, Incorporated, Cincinnati 9, O.
Heald Machine Co., The, Worcester 6, Mass.

GRINDERS (Chucking)

Cross Co., The, 3250 Bellevue Ave., Detroit 7, Mich.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Heald Machine Co., The, Worcester 6, Mass.

GRINDERS (Crank Pin, Cam, Piston, Valve Face)

Cincinnati Grinders, Incorporated, Cincinnati 9, O.
Cross Co., The, 3250 Bellevue Ave., Detroit 7, Mich.
Norton Co., Worcester 6, Mass.

GRINDERS (Cylindrical)

Brown & Sharpe Mfg. Co., Providence 1, R. I.
Cincinnati Grinders, Incorporated, Cincinnati 9, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Norton Co., Worcester 6, Mass.

GRINDERS (Die)

Fitchburg Grinding Machine Corp., Fitchburg, Mass
Landis Machine Co., Waynesboro, Pa.

GRINDERS (Drill)

Mercury Products Co., 423 Euclid Ave., Cleveland 14, O.

GRINDERS (Oscillating)

Cross Co., The, 3250 Bellevue Ave., Detroit 7, Mich.

GRINDERS (Plain and Universal)

Brown & Sharpe Mfg. Co., Providence 1, R. I.
Cincinnati Grinders, Incorporated, Cincinnati 9, O.
Delta Mfg. Co., The, 703N E. Vienna Ave., Milwaukee 1, Wis.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
LeBlond, R. K., Machine Tool Co., The, Cincinnati 8, O.
Lee, K. O., Company, Aberdeen, S. Dak.
Norton Co., Worcester 6, Mass.

GRINDERS (Portable)

Chicago Wheel & Manufacturing Co., Dept. ST, 1101 W. Monroe St., Chicago 7, Ill.
Cleveland Pneumatic Tool Co., The, 3781 E. 77th St., Cleveland 5, O.
Dumore Co., The, 1225 14th St., Racine, Wis.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago 6, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Syntron Co., 370 Lexington Ave., Homer City, Pa.

GRINDERS (Precision Thread)

Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit 6, Mich.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.

GRINDERS (Roll)

Farrel-Birmingham Co., Inc., Ansonia, Conn.
Lewis Fdry. & Mach. Div. of Blaw-Knox Co., Pittsburgh 30, Pa.

GRINDERS (Roll)

Medart Co., The, 3500 DeKalb St., St. Louis 18, Mo.
Mesta Machine Co., P. O. Box 1466 Pittsburgh 30, Pa.
Norton Co., Worcester 6, Mass.
Yoder Co., The, 5500 Walworth Ave., Cleveland 2, O.

GRINDERS (Shear Knife)

Bridgeport Safety Emery Wheel Co., Inc., The, P.O. Box 2031 Stratford, Bridgeport, Conn.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Mattison Machine Works, Rockford, Ill.
Sellers, William, & Co., Inc., 1622 Hamilton St., Philadelphia 20, Pa.

GRINDERS (Sheet Steel & Internal Tube)

Mattison Machine Works, Rockford, Ill.

GRINDERS (Single Slide Internal)

Bryant Chucking Grinder Co., 257 Clinton St. Springfield, Vt.

GRINDERS (Snagging)

Bridgeport Safety Emery Wheel Co., Inc., The, P.O. Box 2031 Stratford, Bridgeport, Conn.

GRINDERS (Spline)

Cross Co., The, 3250 Bellevue Ave., Detroit 7, Mich.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.

GRINDERS (Surface)

Bridgeport Safety Emery Wheel Co., Inc., The, P.O. Box 2031 Stratford, Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence 1, R. I.
Continental Machines, Inc., 1324 Washington Ave., Minneapolis 4, Minn.
Delta Mfg. Co., The, 703N E. Vienna Ave., Milwaukee 1, Wis.
Dumore Co., The, 1225 14th St., Racine, Wis.
Heald Machine Co., The, Worcester 6, Mass.
Mattison Machine Works, Rockford, Ill.
Norton Co., Worcester 6, Mass.

GRINDERS (Tool and Cutter)

Bridgeport Safety Emery Wheel Co., Inc., The, P.O. Box 2031 Stratford, Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence 1, R. I.
Carboloy Co., Inc., 11141 E. 8 Mile Blvd., Detroit 32, Mich.
Cincinnati Milling Machine Co., Cincinnati 9, O.
Delta Mfg. Co., The, 703N E. Vienna Ave., Milwaukee 1, Wis.
Detroit Tap & Tool Co., 8432 Butler St., Detroit 11, Mich.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit 6, Mich.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago 24, Ill.
Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wis.
LeBlond, R. K., Machine Tool Co., The, Cincinnati 8, O.
Lee, K. O., Co., Aberdeen, S. Dak.
Norton Co., Worcester 6, Mass.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland 3, O.
Sellers, William, & Co., Inc., 1622 Hamilton St. Philadelphia 30, Pa.

GRINDING (Shear Knife)

American Shear Knife Co., P.O. Box 355, Homestead, Pa.

GRINDING (Surface)

Chicago Screw Co., The, 1026 S. Homan Ave., Chicago 24, Ill.
Industrial Gear Mfg. Co., 4545 W. Van Buren St., Chicago 24, Ill.

GRINDING MACHINES (Gear)

Cross Co., The, 3250 Bellevue Ave., Detroit 7, Mich.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.

GRINDING—PRECISION (Contract)

Ace Mfg. Corp., 1211 E. Erie Ave., Philadelphia 24, Pa.
Burgess-Norton Mfg. Co., 778 Peyton St., Geneva, Ill.
Chicago Screw Co., The, 1026 S. Homan Ave., Chicago 24, Ill.
Industrial Gear Mfg. Co., 4545 W. Van Buren St., Chicago 24, Ill.

GRINDING WHEELS

Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa.
Bay State Abrasive Products Co., Westboro, Mass.
Bridgeport Safety Emery Wheel Co., Inc., The, P.O. Box 2031 Stratford, Bridgeport, Conn.
Carborundum Co., The, Niagara Falls, N. Y.
Chicago Wheel and Mfg. Co., Dept. ST, 1101 W. Monroe St., Chicago 7, Ill.
deSanno, A. P., & Son Inc., 436 Wheatland St., Phoenixville, Pa.
Detroit-Star Grinding Wheel Co., 111 Cavalry Ave., Detroit 9, Mich.
Dumore Co., The, 1225 14th St., Racine, Wis.
Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Macklin Company, Jackson, Mich.
Norton Co., Worcester 6, Mass.
Peninsular Grinding Wheel Co., 729 Meldrum Ave., Detroit 7, Mich.
Simonds Worden White Co., 714 Negley Place, Dayton 7, O.
Sterling Grinding Wheel Div., of The Cleveland Quarries Co., Tiffin, O.
United States Rubber Co., Mechanical Goods Div., 1230 Sixth Ave., New York 20, N. Y.
United States Steel Supply Co., P. O. Box MM, Chicago 90, Ill.

GRINDING WHEELS (Mounted)

Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa.
Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., The, Niagara Falls, N. Y.
Chicago Wheel & Manufacturing Co., Dept. ST, 1101 W. Monroe St., Chicago 7, Ill.
deSanno, A. P., & Son Inc., 436 Wheatland St., Phoenixville, Pa.
Detroit-Star Grinding Wheel Co., 111 Cavalry Ave., Detroit 9, Mich.
Dumore Co., The, 1225 14th St., Racine, Wis.
Macklin Company, Jackson, Mich.
Norton Co., Worcester 6, Mass.
Peninsular Grinding Wheel Co., 729 Meldrum Ave., Detroit 7, Mich.
Simonds Worden White Co., 714 Negley Place, Dayton 7, O.

GRINDING WHEELS (Segmental)

Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa.
Bay State Abrasive Products Co., Westboro, Mass.
Bridgeport Safety Emery Wheel Co., Inc., The, P.O. Box 2031 Stratford, Bridgeport, Conn.
Carborundum Co., The, Niagara Falls, N. Y.
Detroit-Star Grinding Wheel Co., 111 Cavalry Ave., Detroit 9. Mich.
Macklin Company, Jackson, Mich.
Norton Co., Worcester 6, Mass.
Peninsular Grinding Wheel Co., 729 Meldrum Ave., Detroit 7, Mich.
Simonds Worden White Co., 714 Negley Place, Dayton 7, O.
Sterling Grinding Wheel Div., of The Cleveland Quarries Co., Tiffin, O.

GUARDS (Wire)

Buffalo Wire Works Co., Inc., 437 Terrace Rd., Buffalo 2, N. Y.

GUIDES (Mill)

Ampco Metal Inc., Dept. S-11, Milwaukee 4, Wis.
Haynes Stellite Co., 30 E. 42nd St., New York 17, N. Y.

GUNS (Blast Furnace Mud)

Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh 22, Pa.

GUNS (Steam, Hydraulic, Electric)

Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh 22, Pa.

HAMMER BOARDS

Irwin Mfg. Co., Garland, Pa.

HAMMERS (Drop)

Alliance Machine Co., The, Alliance, O.
Chambersburg Engineering Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Industrial Brownhoist Corp., Bay City, Mich.
Morgan Engineering Co., The, Alliance, O.

HAMMERS (Pneumatic)

Cleveland Pneumatic Tool Co., The, 3781 E. 77th St., Cleveland 5, O.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago 6, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

HAMMERS (Power)

Yoder Co., The, 5500 Walworth Ave., Cleveland 2, O.

HAMMERS (Steam)

Alliance Machine Co., The, Alliance, O.
Chambersburg Engineering Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Industrial Brownhoist Corp., Bay City, Mich.
Morgan Engineering Co., The, Alliance, O.

HANGERS

Bantam Bearings Div., The Torrington Co., South Bend 21, Ind.
Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
Fafnir Bearing Co., New Britain, Conn.
Grinnell Co., Inc., Providence 1, R. I.
Hyatt Bearings Division, General Motors Corp., Harrison, N. J.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Power Piping Div. of Blaw-Knox Co., Beaver & Western Ave., Pittsburgh 2, Pa.
SKF Industries, Inc., Front St. and Erie Ave., Philadelphia 34, Pa.

HAULAGE SYSTEMS

Dempster Brothers, Inc., 294 Shea Rd., Knoxville 17, Tenn.

HEADING MACHINERY

National Machinery Co., Tiffin, O.
Pawtucket Mfg. Co., 327 Pine St., Pawtucket, R. I.

HEAT EXCHANGERS

Babcock & Wilcox Co., The, 85 Liberty St., New York 6, N. Y.
Graver Tank & Mfg. Co., Inc., 4811-29 Tod Ave., E. Chicago, Ind.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y
National Carbon Co., Inc., 30 E. 42nd St., New York 17, N. Y.
Niagara Blower Co., Dept. S-54, 6 E. 45th St., New York 17, N. Y.
Ross Heater & Mfg. Co., Inc., 1431 West Ave., Buffalo 13, N. Y.
Standard Tube Co., The, 14600 Woodward Ave., Detroit 3, Mich.
Struthers Wells Corp., Titusville, Pa.

HEAT TREATING and HARDENING

Burgess-Norton Mfg. Co., 778 Peyton St., Geneva, Ill.
Commercial Metals Treating, Inc., 177 S. St. Clair St., Toledo 1, O.
Holden, A. F., Co., The, P. O. Box 1898, New Haven 8, Conn.
Kaydon Engineering Corp., The, McCracken St., Muskegon, Mich.
Lakeside Steel Improvement Co., The, 5418 Lakeside Ave., Cleveland 14, O.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh 3, Pa.
Pittsburgh Commercial Heat Treating Co., 49th St., & A.V.R.R., Pittsburgh 1, Pa.

HEAT TREATING MATERIALS

Holden, A. F., Co., The, P. O. Box 1898, New Haven 8, Conn.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

HEATERS (Air)

American Blower Corp., 8111 Tireman Ave., Detroit 4, Mich.
Babcock & Wilcox Co., 85 Liberty St., New York 6, N. Y.
Despatch Oven Co., 619 Eighth St., S.E., Minneapolis 14, Minn.
Dravo Corp. (Machinery Div.), 300 Penn Ave., Pittsburgh 22, Pa.
Mahon, R. C., Co., The, 8650 Mt. Elliot Ave., Detroit 11, Mich.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Standard Tube Co., The, 14600 Woodward Ave., Detroit 3, Mich.

HEATERS (Instantaneous)

Hall, C. M., Lamp Co., 1005 E. Hancock St., Detroit 7, Mich.
Ross Heater & Mfg. Co., Inc., 1431 West Ave., Buffalo 13, N. Y.

HEATERS (Unit)

American Blower Corp., 8111 Tireman Ave., Detroit 4, Mich.
American Foundry Equipment Co., 509 S. Byrkit St., Mishawaka, Ind.
Buffalo Forge Co., 158 Mortimer St., Buffalo 5, N. Y.
Cutler-Hammer Inc., 1211 St. Paul Ave., Milwaukee 1, Wis.
Dravo Corp., (Machinery Div.) 300 Penn Ave., Pittsburgh 22, Pa.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Grinnell Co., Inc., Providence 1, R. I.
Hall, C. M., Lamp Co., 1005 E. Hancock St., Detroit 7, Mich.
Niagara Blower Co., Dept. S-54, 6 E. 45th St., New York 17, N. Y.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Sturtevant, B. F., Co., Hyde Park, Boston 36, Mass.
Westinghouse Electric & Mfg. Co., Mansfield, O.

HEATING ELEMENTS (Electric)

Cooley Electric Mfg. Corp., 38 S. Shelby St., Indianapolis 7, Ind.

HELMETS (Blast Cleaning)

American Foundry Equipment Co., 509 S. Byrkit St., Mishawaka, Ind.
Pangborn Corporation, Hagerstown, Md.
Wahlert Products Corp., 27 Lafayette St., Brooklyn 1, N. Y.

HINGES AND BUTTS

Veeder-Root, Inc., Hartford 2, Conn.
Wagner, E. R., Mfg. Co., 4615 N. 32nd St., Milwaukee 9, Wis.

HITCHINGS (Mine Car)

American Chain & Cable Co., Inc., Bridgeport 2, Conn.

HOB CHECKING MACHINES

Detroit Tap & Tool Co., 8432 Butler St., Detroit 11, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

HOBS

Brown & Sharpe Mfg. Co., Providence 1, R. I.
Genesee Tool Co., Fenton, Mich.
Illinois Tool Works, 2501 N. Keeler Ave., Chicago 39, Ill.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

HOIST (Chain)

American MonoRail Co., The, 13102 Athens Ave., Cleveland 7, O.
Chicago Tramrail Co., 2912 W. Carroll Ave., Chicago 12, Ill.
Chisholm-Moore Hoist Corp., 118 Fremont St., Tonawanda, N. Y.
Cleveland Tramrail Div., of The Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Ford Chain Block Div., American Chain & Cable Co., Inc., 2nd & Diamond Sts., Philadelphia 22, Pa.
Reading Chain & Block Corp., 2102 Adams St., Reading, Pa.
United States Steel Supply Co., P. O. Box MM, Chicago 90, Ill.
Wright Mfg. Div. of American Chain & Cable Co., Inc., York, Pa.

HOISTS (Electric)

American MonoRail Co., The, 13102 Athens Ave., Cleveland 7, O.
Browning, Victor R., & Co., Inc., Willoughby, O.
Chicago Tramrail Co., 2912 W. Carroll Ave., Chicago 12, Ill.
Chisholm-Moore Hoist Corp., 118 Fremont St., Tonawanda, N. Y.
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Euclid Crane & Hoist Co., The, 1365 Chardon Rd., Euclid, O.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Industrial Brownhoist Corp., Bay City, Mich

HOISTS (Electric) (Con.)

Reading Chain & Block Corp., 2102 Adams St., Reading, Pa.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.
Silent Hoist & Crane Co., 849 63rd St., Brooklyn 20, N. Y.
United States Steel Supply Co., P. O. Box MM, Chicago 90, Ill.
Wright Mfg. Div. of American Chain & Cable Co. Inc., York, Pa.

HOISTS (Monorail)

American MonoRail Co., The, 13102 Athens Ave., Cleveland 7, O.
Chicago Tramrail Co., 2912 W. Carroll Ave., Chicago 12, Ill.
Chisholm-Moore Hoist Corp., 118 Fremont St., Tonawanda, N. Y.
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Euclid Crane & Hoist Co., The, 1365 Chardon Rd., Euclid, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Reading Chain & Block Corp., 2102 Adams St., Reading, Pa.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

HOISTS (Pneumatic)

Curtis Pneumatic Machinery Div. of Curtis Mfg. Co., 1996 Kienlen Ave., St. Louis 20, Mo.
Galland-Henning Mfg. Co., 2747 S. 31st St., Milwaukee 7, Wis.
Hanna Engineering Works, 1765 Elston Ave., Chicago 22, Ill.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago 6, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

HOISTS (Truck Body)

Dempster Brothers, Inc., 294 Shea Rd., Knoxville 17, Tenn.

HOLE CUTTERS

Wyzenbeek & Staff Inc., 838 W. Hubbard St., Chicago 22, Ill.

HONING MACHINES

Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 4, Mich.
Snyder Tool & Engineering Co., 3400 E. Lafayette St., Detroit 7, Mich.

HOOKS (Chain)

American Chain Div. American Chain & Cable Co., Inc., York, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Phoenix Manufacturing Co., 332 S. Michigan Ave., Chicago 4, Ill.
United States Steel Supply Co., P. O. Box MM, Chicago 90, Ill.

HOOPS (Welded Wire)

American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Keystone Steel & Wire Co., Peoria 7, Ill.

HOOPS—See BANDS AND HOOPS (Iron and Steel)

HOPPERS (Motorized)

Detroit Power Screwdriver Co., 2813 W. Fort St., Detroit 16, Mich.

HOSE (Flexible Metal)

American Metal Hose Branch of The American Brass Co., Waterbury 88, Conn.
Chicago Metal Hose Corp., 1313 S. Third St., Maywood, Ill.
National-Standard Co., Niles, Mich.
Pennsylvania Flexible Metallic Tubing Co., 7250 Powers Lane, Philadelphia 42, Pa.
Titeflex, Inc., 531 Frelinghuysen Ave., Newark 5, N. J.

HOSE (Flexible Nonmetallic)

Weatherhead Co., The, 300 E. 131st St., Cleveland 8, O.

HOSE (Rubber)

Boston Woven Hose & Rubber Co., P.O. Box 1071, Boston 3, Mass.
Cleveland Pneumatic Tool Co., The, 3781 E. 77th St., Cleveland 5, O.
Gates Rubber Co., The, 999 S. Broadway, Denver 17, Colo.
Goodrich, B. F., Co., The, Akron, O.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago 6, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Trabon Engineering Corp., 1818 E. 40th St., Cleveland 3, O.
United States Rubber Co., Mechanical Goods Div., 1230 Sixth Ave., New York 20, N. Y.
United States Steel Supply Co., P.O. Box MM, Chicago 90, Ill.

HOSE CLAMPS, FITTINGS, NIPPLES AND MENDERS

Boston Woven Hose & Rubber Co., P.O. Box 1071, Boston 3, Mass.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Punch-Lok Co., 321 N. Justine St., Chicago 7, Ill.
Trabon Engineering Corp., 1818 E. 40th St., Cleveland 3, O.

HOSE REINFORCEMENT MACHINES

Fidelity Machine Co., 3908-18 Frankford Ave., Philadelphia 24, Pa.

HUMIDIFIERS (Industrial)

Grinnell Co., Inc., Providence 1, R. I.

HYDRAULIC FLUID

Moraine Products Div., General Motors Corp., Dayton 1, O.

HYDRAULIC MACHINERY

Albert, L., & Son, Whitehead Rd., Trenton, N. J.
Alliance Machine Co., The, Alliance, O.
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia 42, Pa.
Beatty Machine & Mfg. Co., Hammond, Ind.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Cross Co., The, 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engineering Co., The, 1163 Dublin Rd., Columbus 16, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago 24, Ill.
Hydraulic Press Mfg. Co., The, Mt. Gilead, O.
Hydropress, Inc., 570 Lexington Ave., New York 22, N. Y.
Morgan Engineering Co., The, Alliance, O.
Schloemann Engineering Corp., 1105 Empire Bldg., Pittsburgh 22, Pa.
Snyder Tool & Engineering Co., 3400 E. Lafayette Ave., Detroit 7, Mich.
Sundstrand Machine Tool Co., 2540 Eleventh St., Rockford, Ill.
Taylor-Wilson Mfg. Co., 15 Thomson Ave., McKees Rocks, Pa.
Wood, R. D., Co., 400 Chestnut St., Philadelphia 5, Pa.

HYDRAULIC PRESSES—See PRESSES (Hydraulic)

HYDRAULIC UNITS

Cross Co., The, 3250 Bellevue Ave., Detroit 7, Mich.
Denison Enginering Co., The, 1163 Dublin Rd., Columbus 16, O.
Ex-Cell-O Corp. 1228 Oakman Blvd., Detroit 6, Mich.
Pesco Products Co., 11610 Euclid Ave., Cleveland 6, O.
Sundstrand Machine Tool Co. 2540 Eleventh St., Rockford, Ill.
Wenman Pump & Supply Co., The, 207-209 Boulevard of the Allies, Pittsburgh 22, Pa.

INDICATORS (Blast Furnace Stock Line)

Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.

INDICATORS (Temperature)

Brown Instrument Co., The, Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia 44, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia 44, Pa.
Westinghouse Electric & Mfg. Co., Orange Ave., Newark 1, N. J.

INDUCTION BRAZING and SOLDERING EQUIPMENT

Ajax Electrothermic Corp., Ajax Park, Trenton 5, N. J.
Federal Telephone & Radio Corp., Div. International Telephone & Telegraph Corp., 32 Central Ave., Newark 1, N. J.
Johnson Gas Appliance Co., 626 "E" Ave., N.W., Cedar Rapids, Iowa.
Lepel High Frequency Laboratories, Inc., 39 W. 60 St., New York 23, N. Y.
Ohio Crankshaft Co., The, 3800 Harvard Ave., Cleveland 1, O.

INDUCTION HARDENING

Chicago Screw Company, The, 1026 S. Homan Ave., Chicago 24, Ill.
Pittsburgh Commercial Heat Treating Co., 49th St. & A.V.R.R., Pittsburgh 1, Pa.

INDUCTION HEATING and HARDENING EQUIPMENT

Ajax Electrothermic Corp., Ajax Park, Trenton 5, N. J.
Federal Telephone & Radio Corp., Div. International Telephone & Telegraph Corp., 32 Central Ave, Newark 1, N. J.
Lepel High Frequency Laboratories, Inc., 39 W. 60 St., New York 23, N. Y.
Ohio Crankshaft Co., The, 3800 Harvard Ave., Cleveland 1, O.
Westinghouse Elctric & Mfg. Co., Baltimore 3, Md.

INFRA-RED EQUIPMENT (Baking, Drying, Dehydrating, Preheating)

Fostoria Pressed Steel Corp., The, Fostoria, O.
Siefen, J. J., Co., 5657 Lauderdale Ave., Detroit 9, Mich.

INGOT MOLD WASH (Graphite)

National Carbon Co., Inc., 30 E. 42nd St., New York 17, N. Y.

INGOT MOLDS

Bethlehem Steel Co., Bethlehem, Pa.
National Carbon Co., Inc., 30 E. 42nd St., New York 17, N. Y.
Shenango-Penn Mold Co., Oliver Bldg., Pittsburgh 22, Pa.
Valley Mould & Iron Corp., Hubbard, O.

INHIBITORS

American Chemical Paint Co., Ambler, Pa.
Kelite, Products Inc., 909 E. 60th St., Los Angeles 1, Cal.

INSERTS (For Molding In)

Bardwell & McAlister, Inc., P. O. Box 1310, Hollywood 28, Cal.

INSERTS, THREADED (Locked In)

Bardwell & McAlister, Inc., P. O. Box 1310, Hollywood 28, Cal.

INSPECTION EQUIPMENT

Electric Eye Equipment Co., 11 W. Fairchild St., Danville, Ill.
Sheffield Corp., The, 721 Springfield St., Dayton 1, O.
Wilkens-Anderson Co., 111 N. Canal St., Chicago 6, Ill.

INSPECTING TOOLS

Electric Eye Equipment Co., 11 W. Fairchild St., Danville, Ill.
Matthews, Jas. H., & Co., 3978 Forbes St., Pittsburgh 13, Pa.
Scherr, George, Co., 202 Lafayette St., New York 12, N. Y.
Sheffield Corp., The, 721 Springfield St., Dayton 1, O.

INSTRUMENTS (Counting)

Electric Eye Equipment Co., 11 W. Fairchild St., Danville, Ill.
Veeder-Root, Inc., Hartford 2, Conn.

INSTRUMENTS (Electric-Indicating and Recording)

Brown Instrument Co., The, Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia 44, Pa.
Brush Development Company, The, 3373 Perkins Ave., Cleveland 14, O.
Electric Eye Equipment Co., 11 W. Fairchild St., Danville, Ill.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
General Electric Co., Schenectady 5, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia 44, Pa.
Sticht, Herman H., Co., 27 Park Place, New York 7, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7N, East Pittsburgh, Pa.

INSTRUMENTS (Testing)

Electric Eye Equipment Co., 11 W. Fairchild St., Danville, Ill.
Wilkens-Anderson Co., 111 N. Canal St., Chicago 6, Ill.

INSULATING BLOCK OR BRICK

Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York 6, N. Y.
Carborundum Co., The, Niagara Falls, N. Y.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
Johns-Manville Corp., 22 E. 40th St., New York 16, N. Y.
National Fireproofing Corp., 202 E. Ohio St., Pittsburgh 12, Pa.

INSULATING CONCRETE

Atlas Lumnite Cement Co., Dept. S, Chrysler Bldg., New York 17, N. Y.
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York 6, N. Y.

INSULATING CONCRETE

Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
Johns-Manville Corp., 22 E. 40th St., New York 16, N. Y.

INSULATING POWDER AND CEMENT

Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York 6, N. Y.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
Johns-Manville Corp., 22 E. 40th St., New York 16, N. Y.
Union Asbestos & Rubber Co., 1821 S. 54th Ave., Cicero 50, Ill.

INSULATION (Building)

Johns-Manville Corp., 22 E. 40th St., New York 16, N. Y.

INSULATION (Furnace, Boiler Settings, Ovens, Steam Pipe, Etc.)

Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
Johns-Manville Corp., 22 E. 40th New York 16, N. Y.
Union Asbestos & Rubber Co., 1821 S. 54th Ave., Cicero 50, Ill.

IRON ORE

Alan Wood Steel Co., Conshohocken, Pa.
Cleveland-Cliffs Iron Co., The, Union Commerce Bldg., Cleveland 14, O.
Hanna Furnace Corp., The, Ecorse, Detroit 18, Mich.
Shenango Furnace Co., Oliver Bldg., Pittsburgh 22, Pa.
Snyder, W. P., & Co., Oliver Bldg., Pittsburgh 22, Pa.

JACKS (Mechanical, Hydraulic, Screw)

Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.

JETS (Steam)

Heil Engineering Co., 12903 Elmwood Ave., Cleveland 11, O.

JIG BORERS

Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago 6, Ill.
Cleereman Machine Tool Co., Green Bay, Wis.

JIGS AND FIXTURES

Ace Mfg. Corp., 1211 E. Erie Ave., Philadelphia 24, Pa.
Black Boring & Machine Co., 1400 E. 222nd St., Cleveland 17, O.
Columbus Die, Tool & Mach. Co. The, 955 Cleveland Ave., Columbus 16, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Master Gauge Co., 2208 Fenkell Ave., Detroit 21, Mich.
Matthews, Jas. H., & Co., 3978 Forbes St., Pittsburgh 13, Pa.
Sheffield Corp., The, 721 Springfield St., Dayton 1, O.
Siewek Tool Co., Div. Domestic Industries Inc., 231 S. LaSalle St., Chicago 4, Ill.
Zagar Tool Inc., 23887 Lakeland Blvd., Euclid, O.

KETTLES (Galvanizing)

National Annealing Box Co., Washington, Pa.

KEYS (Machine or Woodruff)

Moltrup Steel Products Co., Beaver Falls, Pa.

KNIVES

American Shear Knife Co., P.O. Box 355, Homestead, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Cowles Tool Co., 2086 W. 110th St., Cleveland 2, O.
Disston, Henry, & Sons, Inc., 526 Tacony, Philadelphia 35, Pa.
Ohio Knife Co., The, B. & O. R.R. & Dreman Ave., Cincinnati 23, O.
Simonds Worden White Co., 714 Negeley Place, Dayton 7, O.

LABORATORY EQUIPMENT

Dietert, Harry W., Co., 9330 Roselawn Ave., Detroit 4, Mich.

LABORATORY WARE

Bay State Abrasive Products Co., Westboro, Mass.
Norton Company, Worcester 6, Mass.
Wilkens-Anderson Co., 111 N. Canal St., Chicago 6, Ill.

LADLES

Bartlett-Hayward Div., Koppers Co., Baltimore 3, Md.
Bethlehem Steel Co., Bethlehem, Pa.

LAPPING MACHINES

Cincinnti Grinders, Incorporated, Cincinnati 9, O.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit 6, Mich.
National Broach & Machine Co., 5600 St. Jean, Detroit 13, Mich.
Norton Company, Worcester 6, Mass.

LARRIES (Coal)

Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland 10, O.
Differential Steel Car Co., Findlay, O.
Vulcan Iron Works, Wilkes-Barre, Pa.

LATHE CENTERS

Carboloy Co., Inc., 11141 E. 8 Mile Blvd., Detroit 32, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Genesee Tool Co., Fenton, Mich.
Kennametal, Inc., 200 Lloyd Ave., Latrobe, Pa.
Scully-Jones & Co., 1901 S. Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, South Bend 22, Ind.

LATHE DOGS (Drop Forged)

South Bend Lathe Works, South Bend 22, Ind.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

LATHE TOOLS (Carbide Tipped)

Kennametal, Inc., 200 Lloyd Ave., Latrobe, Pa.

LATHES (Automatic)

Brown & Sharpe Mfg. Co., Providence 1, R. I.
Bullard Co., The, Bridgeport 2, Conn.
Cross Co., The, 3250 Bellevue Ave., Detroit 7, Mich.
Gisholt Machine Co., 1217 E. Washington Ave., Madison 3, Wis.
Jones & Lamson Machine Co., Springfield, Vt.
LeBlond, R. K., Machine Tool Co., The, Cincinnati 8, O.
Monarch Machine Tool Co., Sidney, O.
Sheffield Corp., The, 721 Springfield St., Dayton 1, O.
Sundstrand Machine Tool Co. 2540 Eleventh St., Rockford, Ill.
Wickes Brothers, Saginaw, Mich.

LATHES (Buffing & Polishing)

Bridgeport Safety Emery Wheel Co., Inc., The, P.O. Box 2031 Stratford, Bridgeport, Conn.
Chicago Wheel & Mtg. Co., Dept. ST, 1101 W. Monroe St., Chicago 7, Ill.
Delta Mfg. Co., The, 703N E. Vienna Ave., Milwaukee 1, Wis.
Walker-Turner Co., Inc., 50123 Berckman St., Plainfield, N. J.

LATHES (Chucking)

Bullard Co., The, Bridgeport 2, Conn.
Cross Co., The, 3250 Bellevue Ave., Detroit 7, Mich.
Gisholt Machine Co., 1217 E. Washington Ave., Madison 3, Wis.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland 3, O.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, O.

LATHES (Crankshaft)

LeBlond, R. K., Machine Tool Co., The, Cincinnati 8, O.
Wickes Brothers, Saginaw, Mich.

LATHES (Double End)

Consolidated Machine Tool Corp., 565 Blossom Rd. Rochester 10, N. Y.
Snyder Tool & Engineering Co., 3400 E. Lafayette St., Detroit 7, Mich.
Wickes Brothers, Saginaw, Mich.

LATHES (Engine)

Consolidated Machine Tool Corp., 565 Blossom Rd. Rochester 10, N. Y.
LeBlond, R. K., Machine Tool Co., The, Cincinnati 8, O.
Lehmann Machine Co., Chouteau Ave., at Grand, St. Louis 3, Mo.
Logan Engineering Co., 4901 W. Lawrence Ave., Chicago 30, Ill.
Monarch Machine Tool Co., Sidney, O.
South Bend Lathe Works, South Bend 22, Ind.
Wickes Brothers, Saginaw, Mich.

LATHES (Gun)

Consolidated Machine Tool Corp., 565 Blossom Rd., Rochester 10, N. Y.
LeBlond, R. K. Machine Tool Co., The, Cincinnati 8, O.
Lehmann Machine Co., Chouteau Ave., at Grand, St. Louis 3, Mo.
Wickes Brothers, Saginaw, Mich.

LATHES (Railroad Car & Driving Wheel)

Consolidated Machine Tool Corp., 565 Blossom Rd., Rochester 10, N. Y.
Sellers, William, & Co., Inc., 1622 Hamilton St. Philadelphia 30, Pa.

LATHES (Roll Turning)

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown 1, O.
Consolidated Machine Tool Corp., 565 Blossom Rd. Rochester 10, N. Y.
Continental Foundry & Machine Co., E. Chicago, Ind.
Hyde Park Foundry & Machine Co., Hyde Park, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh 30, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh 3, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh 22, Pa.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, O.

LATHES (Turret)

Brown & Sharpe Mfg. Co., Providence 1, R. I.
Bullard Company, The, Bridgeport 2, Conn.
Gisholt Machine Co., 1217 E. Washington Ave., Madison 3, Wis.
Jones & Lamson Machine Co., Springfield, Vt.
Logan Engineering Co., 4901 W. Lawrence Ave., Chicago 30, Ill.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland 3, O.
South Bend Lathe Works, South Bend 22, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, O.

LATHES (Turret, Vertical)

Bullard Co., The, Bridgeport 2, Conn.

LEAD (Pigs)

Anaconda Sales Co., 25 Broadway, New York 4, N. Y.

LEAD (Red, White, Litharge)

Metals Refining Co., Div. of The Glidden Co., 1717 Summer St., Hammond, Ind.
National Lead Co., 111 Broadway, New York 6, N. Y.

LEAD (Sheets, Pipe, etc.)

National Lead Co., 111 Broadway, New York 6, N. Y.

LEAD (Tellurium)

National Lead Co., 111 Broadway, New York 6, N. Y.

LEVELING MACHINES

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown 1, O.
Birdsboro Steel Fdry. & Machine Co., Birdsboro, Pa.
Erie Foundry Co., Erie, Pa.
Hyde Park Foundry & Machine Co. Hyde Park, Pa.
Hydropress, Inc., 570 Lexington Ave., New York 22, N. Y.
Lewis Fdry. & Mach. Div. of Blaw-Knox Co., Pittsburgh 30, Pa.
McKay Machine Co., The Youngstown 2, O.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
Wean Engineering Co., Inc., The, Warren, O.
Yoder Co., The, 5300 Walworth Ave., Cleveland 2, O.

LIFT TRUCKS—See TRUCKS (Lift)

LIFTING MAGNETS—See MAGNETS (Lifting)

LIFTS (Monorail)

American MonoRail Co., The, 13102 Athens Ave., Cleveland 7, O.
Cleveland Crane & Engineering Co., The, 1125 E. 283rd St., Wickliffe, O.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

LIGHTING (Fluorescent Equipment)

Fostoria Pressed Steel Corp., The, Fostoria, O.
General Electric Co., Sec. A-443-90, Tungar & Metallic Rectifier Div., Bridgeport 2, Conn.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Ward Leonard Electric Co., 65 South St., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., 1216 W. 58th St., Cleveland 1, O.

LIGHTING (Industrial)

Fostoria Pressed Steel Corp., The, Fostoria, O.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Westinghouse Electric & Mfg. Co., 1216 W. 58th St., Cleveland 1, O.

LIME (Chemical and Fluxing)

Baker, The J. E., Co., 114 N. George St., York, Pa.

LIMESTONE (Open Hearth & Blast Furnace)

Baker, The J. E., Co., 114 N. George St., York, Pa.
Basic Refractories, Inc., Hanna Bldg., Cleveland 15, O.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.

LINERS (Mill)

Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Taylor-Wharton Iron & Steel Co., Easton, Pa.

LINERS (Pump and Cylinder)

Harrisburg Steel Corp., Harrisburg, Pa.
Shenango-Penn Mold Co., 444 W. Third St., Dover, O.

LOCOMOTIVE CRANES—See CRANES (Locomotive)

LOCOMOTIVES (Diesel-Electric)

Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland 10, O.
Cooper-Bessemer Corp., The, Mt. Vernon, O.
Davenport-Besler Corp., Davenport, Iowa.
Differential Steel Car Co., Findlay, O.
Fate-Root-Heath Co., Plymouth, O.
Plymouth Locomotive Works, Plymouth, O.
Porter, H. K., Company, Inc., 49th & Harrison Sts., Pittsburgh 1, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Diesel-Mechanical)

Davenport-Besler Corp., Davenport, Iowa.
Fate-Root-Heath Co., Plymouth, O.
Plymouth Locomotive Works, Plymouth, O.
Porter, H. K., Company, Inc., 49th & Harrison Sts., Pittsburgh 1, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Electric)

Davenport-Besler Corp., Davenport, Iowa.
Porter, H. K., Company, Inc., 49th & Harrison Sts., Pittsburgh 1, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.

LOCOMOTIVES (Electric Trolley)

Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland 10, O.
Differential Steel Car Co., Findlay, O.
General Electric Co., Schenectady 5, N. Y.
Vulcan Iron Works, Wilkes-Barre, Pa.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Fireless)

Porter, H. K., Company, Inc., 49th & Harrison Sts., Pittsburgh 1, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.

LOCOMOTIVES (Gasoline-Electric)

Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland 10, O.
Davenport-Besler Corp., Davenport, Iowa.
Differential Steel Car Co., Findlay, O.
Fate-Root-Heath Co., Plymouth, O.
General Electric Co., Schenectady 5, N. Y.
Plymouth Locomotive Works, Plymouth, O.
Vulcan Iron Works, Wilkes-Barre, Pa.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Gasoline—Mechanical)

Davenport-Besler Corp., Davenport, Iowa.
Differential Steel Car Co., Findlay, O.
Fate-Root-Heath Co., Plymouth, O.

LOCOMOTIVES (Gasoline—Mechanical) (Con.)

Plymouth Locomotive Works, Plymouth, O.
Vulcan Iron Works, Wilkes-Barre, Pa.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Oil-Electric)

Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland 10, O.
Differential Steel Car Co., Findlay, O.
Vulcan Iron Works, Wilkes-Barre, Pa.

LOCOMOTIVES (Steam)

Davenport-Besler Corp., Davenport, Iowa.
Porter, H. K., Company, Inc., 49th & Harrison Sts., Pittsburgh 1, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.

LOCOMOTIVES (Storage Battery)

Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland 10, O.
General Electric Co., Schenectady 5, N. Y.
Vulcan Iron Works, Wilkes-Barre, Pa.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.
Whitcomb Locomotive Co., Rochelle, Ill.

LOUVERS

Burt Mfg. Company, The, 400 S. High St., Akron 11, O.

LOW TEMPERATURE STORAGE EQUIPMENT

Motor Products Corp., Deep Freeze Div., 2309 Davis St., N. Chicago, Ill.

LUBRICANTS (Drawing)

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Kondor Products Corp., 18120 Sloane Ave., Lakewood 7, O.
New York & New Jersey Lubricant Co., 292 Madison Ave., New York 17, N. Y.
Penola, Inc., 34th & Smallman Sts., Pittsburgh 1, Pa.
Richards, G. Whitfield, 1730 Carlton St., Philadelphia 2, Pa.
Shell Oil Co., Inc., 50 W. 50th St., New York 20, N. Y.

LUBRICANTS (Industrial)

Cities Service Oil Company, Room 164, Sixty Wall Tower New York 5, N. Y.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Kondor Products Corp., 18120 Sloane Ave., Lakewood 7, O.
New York & New Jersey Lubricant Co., 292 Madison Ave., New York 17, N. Y.
Penola, Incorporated, 34th & Smallman Sts., Pittsburgh 1, Pa.
Shell Oil Co., Inc., 50 W. 50th St., New York 20, N. Y.
Sinclair Refining Co., Inc., 630 Fifth Ave., New York 20, N. Y.
Socony-Vacuum Oil Co., Inc., 26 Broadway, New York 4, N. Y.
Sun Oil Co., Dept. 1, 1608 Walnut St., Philadelphia 3, Pa.
Texas Co., The, 135 East 42nd St., New York 17, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York 4, N. Y.

LUBRICATING SYSTEMS

Blaw-Knox Div. of Blaw-Knox Co., Blawnox, Pa.
Farval Corp., The, 3270 E. 80th St., Cleveland 4, O.
Trabon Engineering Corp., 1818 E. 40th St., Cleveland 3, O.

LUGS (Terminal)

Calumet and Hecla Consolidated Copper Co., Wolverine Tube Div., 1439 Central Ave., Detroit 9, Mich.

LUMBER (Flask or Pattern)

Morgan Lumber Sales Co., 8 E. Long St., Columbus, O.

MACHINE WORK

Ace Mfg. Corp., 1211 E. Erie Ave., Philadelphia 24, Pa.
Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Bartlett-Hayward Div., Koppers Co., Baltimore 3, Md.
Birdsboro Steel Fdry. & Machine Co., Birdsboro, Pa.
Commercial Iron Works, P. O. Box 2230, Portland 14, Oreg.
Continental Foundry & Machine Co., E. Chicago, Ind.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.
Federal Shipbuilding & Dry Dock Co., Kearny, N. J.
Fidelity Machine Co., 3908-18 Frankfort Ave., Philadelphia 24, Pa.
Hanna Engineering Works, 1765 Elston Ave., Chicago 22, Ill.
Hyde Park Foundry & Machine Co., Hyde Park, Pa.
Hydraulic Press Mfg. Co., The, Mt. Gilead, O.
Kaydon Engineering Corp., The, McCracken St., Muskegon, Mich.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh 30, Pa.
Lewthwaite, T. H., Machine Co., Inc., 311 E. 47th St., New York 17, N. Y.
Mercury Products Co., 423 Euclid Ave., Cleveland 14, O.
Morgan Engineering Co., The Alliance, O.
Pittsburgh Steel Foundry Corp., Glassport, Pa.
Scaife Co., Ann St., Oakmont Pa.
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh 23, Pa.

MACHINERY (Automatic Transfer Processing)

Greenlee Bros. & Co., 1927 Mason Ave., Rockford, Ill.

MACHINERY (Bag Closing)

Fidelity Machine Co., 3908-18 Frankfort Ave., Philadelphia 24, Pa.

MACHINERY (Die-Casting)

Harvill, H. L., Mfg. Co., P. O. Box K, Vernon, Cal.
Hydraulic Press Mfg. Co., The, Mt. Gilead, O.
Lester-Phoenix, Inc., 2629 Church Ave., Cleveland 13, O.

MACHINERY (Flexible Shaft)—See FLEXIBLE SHAFT MACHINERY

MACHINERY (Lithographing)

Wagner Litho Machinery Co., Hoboken, N. J.

MACHINERY (Plastic Molding)

Birdsboro Steel Fdry. & Machine Co., Birdsboro, Pa.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Hydraulic Press Mfg. Co., The, Mt. Gilead, O.
Lester-Phoenix, Inc., 2629 Church Ave., Cleveland 13, O.
Standard Products Co., The, 505 Boulevard Bldg., Detroit 2, Mich.

MACHINERY (Special)

Acme Pattern & Tool Co., Inc., 232 Findlay St., Dayton 3, O.
Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown 1, O.
Alliance Machine Co., The, Alliance, O.
American Foundry Equipment Co., 509 S. Byrkit St., Mishawaka, Ind.
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland 10, O.
Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh 22, Pa.
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia 42, Pa.
Bartlett-Hayward Div., Koppers Co., Baltimore 3, Md.
Beatty Machine & Mfg. Co., Hammond, Ind.
Birdsboro Steel Fdry. & Machine Co., Birdsboro, Pa.
Brandt, Charles T., Inc., 1702 Ridgely St., Baltimore 30, Md.
Cleveland Automatic Machine Co., 2269 Ashland Ave., Cleveland 3, O.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland 14, O.
Columbus Die, Tool & Machine Co., The, 955 Cleveland Ave., Columbus 16, O.
Consolidated Steel Corp., Ltd., 5700 S. Eastern Ave., Los Angeles 22, Cal.
Continental Machines, Inc., 1324 Washington Ave., Minneapolis 4, Minn.
Continental Foundry & Machine Co., E. Chicago, Ind.
Cross Co., The, 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engineering Co., The, 1163 Dublin Rd., Columbus 16, O.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit 6, Mich.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Fidelity Machine Co., 3908-18 Frankfort Ave., Philadelphia 24, Pa.
Foote Bros. Gear & Machine Co., 5225 S. Western Blvd., Chicago 9, Ill.
Greenlee Bros. & Co., 1927 Mason Ave., Rockford, Ill.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago 24, Ill.
Lapointe Machine Tool Co., The, 34 Tower St., Hudson, Mass.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh 30, Pa.
Medart Co., The, 3500 DeKalb St., St. Louis 18, Mo.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
Morgan Engineering Co., The Alliance, O.
Mercury Products Co., 423 Euclid Ave., Cleveland 14, O.
National Broach & Machine Co., 5600 St. Jean, Detroit 13, Mich.
National Roll & Fdry. Co., The, Avonmore, Pa.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo 11, N. Y.
Oil Well Supply Co., Dallas 1, Texas.
Sellers, William, & Co., Inc., 1622 Hamilton St., Philadelphia 30, Pa.
Sheffield Corp., The, 721 Springfield St., Dayton 1, O.
Shuster, F. B., Mfg. Co., Inc., The, New Haven 9, Conn.
Snyder Tool & Engineering Co., 3400 E. Lafayette Ave., Detroit 7, Mich.
Struthers Wells Corp., Titusville, Pa.
Sundstrand Machine Tool Co., 2540 Eleventh St., Rockford, Ill.
Taylor-Wilson Mfg. Co., 15 Thomson Ave., McKees Rocks, Pa.
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh 23, Pa.
United Engineering & Fdry Co., First National Bank Bldg., Pittsburgh 22, Pa.
U. S. Automatic Corp., Amherst, O.
Wagner Litho Machinery Co., Hoboken, N. J.
Wean Engineering Co., Inc., The, Warren, O.
Wood, R. D., Co., 400 Chestnut St., Philadelphia 5, Pa.
Yoder Co., The, 5500 Walworth Ave., Cleveland 2, O.
Youngstown Welding & Eng. Co. The, 3711 Oakwood Ave., Youngstown 9, O.

MACHINERY (Used & Rebuilt)

Albert, L. & Son, Whitehead Rd., Trenton, N. J.
Dulien Steel Products, Inc., 414 First Ave., So., Seattle, Wash.
General Blower Co., 404 N. Peoria St., Chicago 22, Ill.
Iron & Steel Products, Inc., Hegewisch Sta., Chicago 33, Ill.
Sonken-Galamba Corp., 108 N. 2nd St., Kansas City, Kansas
West Penn Machinery Co., 1208 House Bldg., Pittsburgh 22, Pa.

MACHINERY (WELDING WIRE)

Shuster, F. B., Mfg. Co., Inc., The New Haven 9, Conn.

MACHINERY INSTALLING AND RELOCATING

Eichleay Engineering Corp., 33 S. 19th St., Pittsburgh 3, Pa.

MACHINES (Marking)

Matthews, Jas. H., & Co., 3978 Forbes St., Pittsburgh 13, Pa.

MAGNESIA (Electrically Fused)

Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Norton Co., Worcester 6, Mass.

MAGNESIA-REFRACTORIES—See REFRACTORIES (Magnesia)

MAGNESIUM

Dow Chemical Co., The, Midland, Mich.

MAGNETIC SEPARATORS—See SEPARATORS (Magnetic)

MAGNETS (Lifting)

Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee 1, Wis.
Electric Controller & Mfg. Co., The, 2698 E. 79th St., Cleveland 4, O.
Ohio Electric Mfg. Co., The, 5906 Maurice Ave., Cleveland 4, O.

MAGNETS (Separating)

Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee 1, Wis.
Electric Controller & Mfg. Co., The, 2698 E. 79th St., Cleveland 4, O
Ohio Electric Mfg. Co., The, 5906 Maurice Ave., Cleveland 4, O.

MANDRELS (Expanding)

Lee, K. O., Company, Aberdeen, S. Dak.

MANGANESE METAL AND ALLOYS

Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Electro Metallurgical Co., 30 E. 42nd St., New York 17, N. Y.
Taylor-Wharton Iron & Steel Co., Easton, Pa.

MANGANESE ORE

Cuban-American Manganese Corp., 122 E. 42nd St., New York 17, N. Y.
Samuel, Frank & Co., Inc., Harrison Bldg., Philadelphia 2, Pa.

MANIFOLDS (Cylinder)

Air Reduction, 60 E. 42nd St., New York 17, N. Y.
Linde Air Products Co., The, 30 E. 42nd St., New York 17, N. Y.
Victor Equipment Co., 844-54 Folsom St., San Francisco 7, Cal.

MANIPULATORS

Alliance Machine Co., The, Alliance, O.
Birdsboro Steel Fdry. & Machine Co., Birdsboro, Pa.
Continental Foundry & Machine Co., E. Chicago, Ind.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
Morgan Engineering Co., The, Alliance, O.
Wellman Engineering Co., The, 7016 Central Ave., Cleveland 4, O.

MARKING DEVICES

American Crayon Co., Sandusky, O.
Cunningham, M. E., Co., 172 E. Carson St., Pittsburgh 19, Pa.
Matthews, Jas. H., & Co., 3978 Forbes St., Pittsburgh 13, Pa.

MATS and MATTING (Wire)

Buffalo Wire Works Co., Inc., 437 Terrace Rd., Buffalo 2, N. Y.

METAL (Perforated)—See PERFORATED METAL

METAL CLEANERS

American Chemical Paint Co., Ambler, Pa.
Holden, A. F., Co., The, P.O. Box 1898, New Haven 8, Conn.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Kelite Products Inc., 909 E. 60th St., Los Angeles 1, Cal.
Kondor Products Corp., 18120 Sloane Ave., Lakewood 7, O.
Pennsylvania Salt Mfg. Co., Dept. S. Pennsalt Cleaner Div., Philadelphia 7, Pa.
Turco Products, Inc., 6135 S. Central Ave., Los Angeles 54, Cal.
Udylite Corp., The, 1651 E. Grand Blvd., Detroit 11, Mich.
United States Steel Supply Co., P. O. Box MM, Chicago 90, Ill.

METAL CLEANING MACHINES

Alvey-Ferguson Co., The, 85 Disney St., Cincinnati 9, O.
American Foundry Equipment Co., 509 S. Byrkit St., Mishawaka, Ind.
Brandt, Charles T., Inc., 1702 Ridgley St., Baltimore 30, Md.
Bullard Co., The, Bridgeport 2, Conn.
Mahon, R. C., Co., The, 8650 Mt. Elliott Ave., Detroit 11, Mich.
Pangborn Corporation, Hagerstown, Md.
Ransohoff, N., Inc., 1317 Township Ave., Cincinnati 16, O.
Salem Engineering Co., 714 S. Broadway, Salem, O.

METAL DUPLICATION (Without Dies)

O'Neil-Irwin Mfg. Co., 304 8th Ave., So., Minneapolis 15, Minn.

METAL FINISHES

American Chemical Paint Co., Ambler, Pa.

METAL POWDERS—See POWDERS, (Metal)

METAL WASHING EQUIPMENT

Alvey-Ferguson Co., The, 85 Disney St., Cincinnati 9, O.
American Foundry Equipment Co., 509 S. Byrkit St., Mishawaka, Ind.
Holden, A. F., Co., The, P. O. Box 1898, New Haven 8, Conn.

METALS (Nonferrous)

Ajax Metal Co., Philadelphia 43, Pa.
Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
American Brass Co., The, Waterbury 88, Conn. Milwaukee 4, Wis.
Ampco Metal Inc., Dept. S-11, Milwaukee 4, Wis.
Bohn Aluminum & Brass Corp., Lafayette Bldg., Detroit 26, Mich.
Bridgeport Brass Co., Bridgeport, Conn.
Bristol Brass Corp., The, Bristol, Conn.
Bunting Brass & Bronze Co., The, 715 Spencer St., Toledo 1, O.
Cadman, A. W. Mfg. Co., 28th & Smallman Sts., Pittsburgh 22, Pa.
Copperweld Steel Co., Warren, O.
Dow Chemical Co., The, Midland, Mich.
Handy & Harman, 82 Fulton St., New York 7, N. Y.
Harper, The, H. M. Co., 2646 Fletcher St., Chicago 18, Ill.
International Nickel Co., Inc., The, 67 Wall St., New York 5, N. Y.
Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.
National Bearing Metals Corp., 4930 Manchester Ave., St. Louis 10, Mo.
New Jersey Zinc Co., The, 160 Front St., New York 7, N. Y.
Revere Copper & Brass Inc., 230 Park Ave., New York 17, N. Y.
Shenango-Penn Mold Co., 444 W. Third St., Dover, O.
Western Cartridge Co., Brass Mill Div., East Alton, Ill.

METALS (Nonferrous—Corrosion & Abrasive Resistant)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
Haynes Stellite Co., 30 E. 42nd St., New York 17, N. Y.
Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

METALS (Prefinished)

American Nickeloid Co., 1310 Second St., Peru, Ill.

METALS (Silver Clad)

Handy & Harman, 82 Fulton St., New York 7, N. Y.
Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.

METERS (Air & Hydraulic)

Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.

MICROMETERS

Brown & Sharpe Mfg. Co., Providence 1, R. I.
Scherr, George, Co., 202 Lafayette St., New York 12, N. Y.

MILLING CUTTERS

Brown & Sharpe Mfg. Co., Providence 1, R. I.
Carboloy Co., Inc., 11141 E. 8 Mile Blvd., Detroit 32, Mich.
Cowles Tool Co., 2086 W. 110th St., Cleveland 2, O.
Detroit Tap & Tool Co., 8432 Butler St., Detroit 11, Mich.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit 6, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Genesee Tool Co., Fenton, Mich.
Haynes Stellite Co., 30 E. 42nd St., New York 17, N. Y.
Illinois Tool Works, 2501 N. Keeler Ave., Chicago 39, Ill.
Kennametal, Inc., 200 Lloyd Ave., Latrobe, Pa.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Plan-O-Mill Corp., 1511 E. Eight Mile Rd., Hazel Park, Mich.
Scully-Jones & Co., 1901 S. Rockwell St., Chicago 8, Ill.
Siewek Tool Co., Div. Domestic Industries Inc., 231 S. LaSalle St., Chicago 4, Ill.

MILLING MACHINE ATTACHMENTS

Brown & Sharpe Mfg. Co., Providence 1, R. I.
Cincinnati Milling Machine Co., Cincinnati 9, O.
Giddings & Lewis Machine Tool Co., 148 Doty St., Fond Du Lac, Wis.
Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wis.

MILLING MACHINES

Brown & Sharpe Mfg. Co., Providence 1, R. I.
Cincinnati Milling Machine Co., Cincinnati 9, O.
Consolidated Machine Tool Corp., 565 Blossom Rd., Rochester 10, N. Y.
Cross Co., The, 3250 Bellevue Ave., Detroit 7, Mich.
Giddings & Lewis Machine Tool Co., 148 Doty St., Fond Du Lac, Wis.
Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee, Wis.
National Broach & Machine Co., 5600 St. Jean, Detroit 13, Mich.
Nichols, W. H., and Sons, Waltham 54, Mass.
Plan-O-Mill Corp., 1511 E. Eight Mile Rd., Hazel Park, Mich.
Sellers, William, & Co., Inc., 1622 Hamilton St., Philadelphia 30, Pa.
Snyder Tool & Engineering Co., 3400 E. Lafayette Ave., Detroit 7, Mich
Sundstrand Machine Tool Co., 2540 Eleventh St., Rockford, Ill.

MILLING MACHINES (Milling and Centering Combined)

Cross Co., The, 3250 Bellevue Ave., Detroit 7, Mich.
Jones & Lamson Machine Co., Springfield, Vt.
Snyder Tool & Engineering Co., 3400 E. Lafayette Ave., Detroit 7, Mich.
Sundstrand Machine Tool Co., 2540 Eleventh St., Rockford, Ill.

MILLS (Blooming, Universal, Plate, Sheet, Tin, Bar, Strip, Etc.)—See ROLLING MILL EQUIPMENT

MIXERS (Hot Metal)

Bartlett-Hayward Div., Koppers Co., Baltimore 3, Md.

MIXING EQUIPMENT

Porter, H. K., Company, Inc., 49th & Harrison Sts., Pittsburgh 1, Pa.

MOLD PLUGS

National Carbon Co., Inc., 30 E. 42nd St., New York 17, N. Y.

MOLDS (Ingot)—See INGOT MOLDS

MOLYBDENUM

Climax Molybdenum Co., 500 Fifth Ave., New York 18, N. Y.
Molybdenum Corp. of America, Grant Bldg., Pittsburgh 19, Pa.

MONEL METAL (All Commercial Forms)

International Nickel Co., Inc., The, 67 Wall St., New York 5, N. Y.

MONORAIL SYSTEMS

American MonoRail Co., The, 13102 Athens Ave., Cleveland 7, O.
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., 1125 E. 283 St., Wickliffe, O.
Mississippi Valley Structural Steel Co., Melrose Park, Ill.
Reading Chain & Block Corp., 2102 Adams St., Reading, Pa.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.

MOTOR CONTROLS

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Clark Controller Co., The, 1146 E. 152nd St., Cleveland 10, O.
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee 1, Wis.
Electric Controller & Mfg. Co., The, 2698 E. 79th St., Cleveland 4, O.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Square D Co., 4041 N. Richards St., Milwaukee 12, Wis.
Ward Leonard Electric Co., 65 South St., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

MOTOR-GENERATORS

Kato Engineering Co., Mankato, Minn.

MOTOR-ROLLERS

Schloemann Engineering Corp., 1105 Empire Bldg., Pittsburgh 22, Pa.

MOTORS (Electric)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Century Electric Co., 1806 Pine St., St. Louis 3, Mo.
Delta Mfg. Co., The, 703N E. Vienna Ave., Milwaukee 1, Wis.
Dumore Co., The, 1225 14th St., Racine, Wis.
Fairbanks, Morse & Co., Fairbanks-Morse Bldg., Chicago 5, Ill.
General Electric Co., Schenectady 5, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Lincoln Electric Co., The, Cleveland 1, O.
Master Electric Co., The, 100 Davis Ave., Dayton 1, O.
Reliance Electric & Eng. Co., 1088 Ivanhoe Rd., Cleveland 10, O.
Sturtevant, B. F., Co., Hyde Park, Boston 36, Mass.
Walker-Turner Co., Inc., 50123 Berckman St., Plainfield, N. J.
Wesche, B. A., Electric Co., The, 1628 Vine St., Cincinnati 10, O.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

MOUNTINGS (Rubber)

Goodrich, B. F., Co., The, Akron, O.
United States Rubber Co., Mechanical Goods Div., 1230 Sixth Ave., New York 20, N. Y.

MUCK BAR

Samuel, Frank, & Co., Inc., Harrison Bldg., Philadelphia 2, Pa.

MUFFLERS (Spark Arresting)

Donaldson Co., Inc., 666 Pelham St., St. Paul 4, Minn.

NAILS (*Also Stainless)

Alan Wood Steel Co., Conshohocken, Pa.
Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Bethlehem Steel Co., Bethlehem, Pa.
*Columbia Steel Co., San Francisco 6, Cal.
Continental Steel Corp., Kokomo, Ind.
Grammes, L. F., & Sons, Inc., Allentown, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Keystone Steel & Wire Co., Peoria 7, Ill.
*Republic Steel Corp., Dept. ST, Cleveland 4, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham 2, Ala.
Wickwire Brothers, Inc., 189 Main St., Cortland, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

NAILS (Coated & Galvanized)

Alan Wood Steel Co., Conshohocken, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Bethlehem Steel Co., Bethlehem, Pa.
Keystone Steel & Wire Co., Peoria 7, Ill.
Wickwire Brothers, Inc., 189 Main St., Cortland, N. Y.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

NAME PLATES

Grammes, L. F., & Sons, Inc., Allentown, Pa.
Matthews, Jas. H., & Co., 3978 Forbes St., Pittsburgh 13, Pa.

NETTING (Wire)

Buffalo Wire Works Co., Inc., 437 Terrace Rd., Buffalo 2, N. Y.

NIBBLING MACHINES

Andrew C. Campbell Div., American Chain & Cable Co., Inc., Brideport 2, Conn.

NICKEL (All Commercial Forms)

International Nickel Co., Inc., The, 67 Wall St., New York 5, N. Y.

NITRIDING

Holden, A. F., Co., The, P. O. Box 1898, New Haven 8, Conn.
Nitralloy Corp., The, 230 Park Ave., New York 17, N. Y.
Pittsburgh Commercial Heat Treating Co., 49th St. & A.V.R.R., Pittsburgh 1, Pa.

NOZZLES

Aidrich Pump Co., The 8 Pine St., Allentown, Pa.
American Foundry Equipment Co., 509 S. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.

NUTS (*Also Stainless)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Bolt Co., 101 East Ave., N. Tonawanda, N. Y.
Cleveland Cap Screw Co., 2935 E. 79th St., Cleveland 4, O.
*Detroit Nut Company, Hubbard Ave. & M.C.R.R., Detroit 9, Mich.
*Elastic Stop Nut Corp., 982 Stuyvesant Ave., Union, N. J.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.
*Harper, H. M. Co., The, 2646 Fletcher St., Chicago 18, Ill.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland 2, O.
*National Screw & Mfg. Co., The, 2440 E. 75th St., Cleveland 4, O.
*Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh 3, Pa.
Pawtucket Mfg. Co., 327 Pine St., Pawtucket, R. I.
*Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland 13, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
*Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.
*Stover Lock Nut & Machinery Corp., Easton, Pa.
Tinnerman Products, Inc., 2039 Fulton Rd., Cleveland 13, O.
Triplex Screw Co., 5341 Grant Ave., Cleveland 5, O.

NUTS (Acorn or Cap)

Chicago Screw Co., The, 1026 S. Homan Ave., Chicago 24, Ill.
Ferry Cap & Set Screw Co., 2151 Scranton Rd., Cleveland 13, O.
Harper Co., H. M., The, 2646 Fletcher St., Chicago 18, Ill.
National Screw & Mfg. Co., The, 2440 E. 75th St., Cleveland 4, O.
U. S. Automatic Corp., Amherst, O.

NUTS (Castellated)

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Screw Company, The, 1026 S. Homan Ave., Chicago 24, Ill.
Cleveland Cap Screw Co., 2935 E. 79th St., Cleveland 4, O.
Detroit Nut Company, Hubbard Ave. & M.C. R.R., Detroit 9, Mich.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland 2, O.
National Acme Co., The, 170 E. 131 St., Cleveland 8, O.
National Screw & Mfg. Co., The, 2440 E. 75th St., Cleveland 4, O.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland 13, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.
U. S. Automatic Corp., Amherst, O.

NUTS (Machine Screw)

Buffalo Bolt Co., 101 East Ave., N. Tonawanda, N. Y.
Elastic Stop Nut Corp., 982 Stuyvesant Ave., Union, N. J.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.
National Screw & Mfg. Co., The, 2440 E. 75th St., Cleveland 4, O.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.
Stover Lock Nut & Machinery Corp., Easton, Pa.
U. S. Automatic Corp., Amherst, O.

NUTS (Nonferrous)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
Chicago Screw Company, The, 1026 S. Homan Ave., Chicago 24, Ill.
Detroit Nut Company, Hubbard Ave. & M.C. R.R., Detroit 9, Mich.
Elastic Stop Nut Corp., 982 Stuyvesant Ave., Union, N. J.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.
Harper, H. M., Co., The, 2646 Fletcher St., Chicago 18, Ill.
National Screw & Mfg. Co., The, 2440 E. 75th St., Cleveland 4, O.
Pawtucket Mfg. Co., 327 Pine St., Pawtucket, R. I.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.
U. S. Automatic Corp., Amherst, O.

NUTS (Self Locking)

Bethlehem Steel Co., Bethlehem, Pa.
Elastic Stop Nut Corp., 982 Stuyvesant Ave., Union, N. J.
National Screw & Mfg. Co., The, 2440 E. 75th St., Cleveland 4, O.
Stover Lock Nut & Machinery Corp., Easton, Pa.
Tinnerman Products, Inc., 2039 Fulton Rd., Cleveland 13, O.

NUTS (Semi-finished)

Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Bolt Co., 101 East Ave., N. Tonawanda, N. Y.
Chicago Screw Company, The, 1026 S. Homan Ave., Chicago 24, Ill.
Cleveland Cap Screw Co., 2935 E. 79th St., Cleveland 4, O.
Detroit Nut Company, Hubbard Ave. & M.C. R.R., Detroit 9, Mich.
Ferry Cap & Set Screw Co., 2151 Scranton Rd., Cleveland 13, O.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland 2, O.
National Screw & Mfg. Co., The, 2440 E. 75th St., Cleveland 4, O.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh 3, Pa.
Pawtucket Mfg. Co., 327 Pine St., Pawtucket, R. I.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland 13, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.

NUTS (Spring—Tension)

Tinnerman Products, Inc., 2039 Fulton Rd., Cleveland 13, O.

NUTS (Wing)

National Screw & Mfg. Co., The, 2440 E. 75th St., Cleveland 4, O.
Parker-Kalon Corp., 194-200 Varick St., New York 14, N. Y.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

OFFICE EQUIPMENT

Diebold, Incorporated 818 Mulberry Rd., Canton 2, O.
Remington-Rand Inc., Systems Div., 499 Washington St., Buffalo 3, N. Y.
United Autographic Register Co., 5000 S. California Ave., Chicago 32, Ill.

OIL SEALS

Chicago Rawhide Mfg. Co., 1308 Elston Ave., Chicago 22, Ill.
Michigan Leather Products Co., 6315 E. Lafayette Ave., Detroit 7, Mich.
Syntron Co., 370 Lexington Ave., Homer City, Pa.

OILS (Cutting)

Cities Service Oil Company, Room 164, Sixty Wall Tower New York 5, N. Y.
DoAll Company, The, 231 N. Laurel Ave., Des Plaines, Ill.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Oakite Products, Inc., 34E Thames St., New York 6, N. Y.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland 3, O.
Penola, Incorporated, 34th & Smallman Sts., Pittsburgh 1, Pa.
Richards, G. Whitfield, 1730 Carlton St., Philadelphia 2, Pa.
Shell Oil Co., Inc., 50 W. 50th St., New York 20, N. Y.
Sinclair Refining Co., Inc., 630 Fifth Ave., New York 20, N. Y.
Socony-Vacuum Oil Co., Inc., 26 Broadway, New York 4, N. Y.
Sun Oil Co., Dept. 1, 1608 Walnut St., Philadelphia 3, Pa.
Texas Co., The, 135 East 42nd St., New York 17, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York 4, N. Y.

OILS (Lubricating)—See LUBRICANTS (Industrial)

OILS (Quenching)

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

OPEN-HEARTH FURNACES—See FURNACES (Open-Hearth)

OVENS (Annealing, Japanning, Tempering)

Despatch Oven Co., 619 Eighth St., S.E., Minneapolis 14, Minn.
Electric Furnace Co., The, 440 W. Wilson St., Salem, O.
Hagan, George J., Co., 2400 E. Carson St., Pittsburgh 3, Pa.
Hall, C. M., Lamp Co., 1005 E. Hancock St., Detroit 7, Mich.
Industrial Oven Engineering Co., The 11621 Detroit Ave., Cleveland 2, O.
Maehler, Paul, Co., The, 2208 W. Lake St., Chicago 12, Ill.
Mahon, R. C., Co., The, 8650 Mt. Elliott Ave., Detroit 11, Mich.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Tate-Jones & Co., Inc., Leetsdale, Pa.

OVENS (Baking & Drying)

Brandt, Charles T., Inc., 1702 Ridgley St., Baltimore 30, Md.
Fostoria Pressed Steel Corp., The, Fostoria, O.
Hall, C. M., Lamp Co., 1005 E. Hancock St., Detroit 7, Mich.
Industrial Oven Engineering Co., The, 11621 Detroit Ave., Cleveland 2, O.
Siefen, J. J., Co., 5657 Lauderdale Ave., Detroit 9, Mich.
Tate-Jones & Co., Inc., Leetsdale, Pa.
Wagner Litho Machinery Co., Hoboken, N. J.

OVENS (Coke, By-Product)

Koppers Co., Engineering and Construction Div., 300 Koppers Bldg., Pittsburgh 19, Pa.

OVENS (Core and Mold)

Despatch Oven Co., 619 Eighth St., S.E., Minneapolis 14, Minn.
Hall, C. M., Lamp Co., 1005 E. Hancock St., Detroit 7, Mich.
Industrial Oven Engineering Co., The, 11621 Detroit Ave., Cleveland 2, O.
Maehler, Paul, Co., The, 2208 W. Lake St., Chicago 12, Ill.
Mahon, R. C., Co., The, 8650 Mt. Elliott Ave., Detroit 11, Mich.
Tate-Jones & Co., Inc., Leetsdale, Pa.

OVENS (Gas or Oil Heat)

Industrial Oven Engineering Co., The, 11621 Detroit Ave., Cleveland 2, O.
Maehler, Paul, Co., The, 2208 W. Lake St., Chicago 12, Ill.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Tate-Jones & Co., Inc., Leetsdale, Pa.

OXY-ACETYLENE WELDING AND CUTTING—See WELDING

OXYGEN

Air Reduction, 60 E. 42nd St., New York 17, N. Y.
Linde Air Products Co., The, 30 E. 42nd St., New York 17, N. Y.

OXYGEN GENERATORS

Independent Engineering Co., O'Fallon, Ill.

PACKING (Asbestos or Rubber)

Goodrich, B. F., Co., The, Akron, O.
Johns-Manville Corp., 22 E. 40th St., New York 16, N. Y.
Union Asbestos & Rubber Co., 1821 S. 54th Ave., Cicero 50, Ill.
United States Rubber Co., Mechanical Goods Div., 1230 Sixth Ave., New York 20, N. Y.

PACKING (Carbon or Graphite)

National Carbon Co., Inc., 30 E. 42nd St., New York 17, N. Y.

PACKINGS (Mechanical Leather)

Chicago Rawhide Mfg. Co., 1308 Elston Ave., Chicago 22, Ill.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Michigan Leather Products Co., 6315 E. Lafayette Ave., Detroit 7, Mich.

PAINT (Alkali Resisting)

Pennsylvania Salt Mfg. Co., 1000 Widener Bldg., Philadelphia 7, Pa.

PAINT (Aluminum)

Aluminum Industries, Inc., 2438 Beekman St., Cincinnati 25, O.
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh 19, Pa.

PAINT (Heat Resisting, Rust Preventing, Priming)

Aluminum Industries, Inc., 2438 Beekman St., Cincinnati 25, O.
American Chemical Paint Co., Ambler, Pa.
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh 19, Pa.
Pennsylvania Salt Mfg. Co., 1000 Widener Bldg., Philadelphia 7, Pa.

PAINTS and LACQUERS (Industrial)

Aluminum Industries, Inc., 2438 Beekman St., Cincinnati 25, O.
National Lead Co., 111 Broadway, New York 6, N. Y.
Pittsburgh Plate Glass Co., Paint Div., 632 Duquesne Way, Pittsburgh 22, Pa.
Standard Varnish Works, 2600 Richmond Terrace Staten Island 3, N. Y.

PAINT (Marking)

American Crayon Co., Sandusky, O.
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh 19, Pa.
Markal Company, 631 N. Western Ave., Chicago 12, Ill.

PAINT (Stick Form)

American Crayon Co., Sandusky, O.
United States Steel Supply Co., P. O. Box MM, Chicago 90, Ill.

PAINT REMOVERS

Kelite Products Inc., 909 E. 60th St., Los Angeles 1, Cal.

PAINTING

Hanlon-Gregory Galvanizing Co., 5515 Butler St., Pittsburgh 1, Pa.
Kelite Products Inc., 909 E. 60th St., Los Angeles 1, Cal.

PAPER (Reinforced)

Sisalkraft Co., The, 205 W. Wacker Drive, Chicago 6, Ill.

PAPER (Waterproof)

Sisalkraft Co., The, 205 W. Wacker Drive, Chicago 6, Ill.

PAPER (Wrapping—Fibre Reinforced)

Sisalkraft Co., The, 205 W. Wacker Drive, Chicago 6, Ill.

PARTITIONS (Wire)

Buffalo Wire Works Co., Inc., 437 Terrace Rd., Buffalo 2, N. Y.

PARTS (Precision)

Brandt, Charles T., Inc., 1702 Ridgley St., Baltimore 30, Md.
Burgess-Norton Mfg. Co., 778 Peyton St., Geneva, Ill.
Chicago Screw Company, The, 1026 S. Homan Ave., Chicago 24, Ill.
Dresser Mfg. Co., Bradford, Pa.
Elastic Stop Nut Corp., 982 Stuyvesant Ave., Union, N. J.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit 6, Mich.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.
Fidelity Machine Company, 3908-18 Frankford Ave., Philadelphia 24, Pa.
Kaydon Engineering Corp., The, McCracken St., Muskegon, Mich.

PARTS (Precision-Diesel)

Aircraft & Diesel Equipment Corp., 4401 N. Ravenswood Ave., Chicago 40, Ill.
Chicago Screw Company, The, 1026 S. Homan Ave., Chicago 24, Ill.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.

PATTERNS (Wood or Metal)

Acme Pattern & Tool Co. Inc., 232 Findlay St., Dayton 3, O.
Hedstrom, Oscar W., Corp., 4824 W. Division St., Chicago 51, Ill.
Wellman Bronze & Aluminum Co., The, 2539 E. 93 St., Cleveland 4, O.

PERFORATED METAL

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Chicago Perforating Co., 2443 W. 24th Pl., Chicago 8, Ill.
Diamond Mfg Co., Wyoming, Pa
Erdle Perforating Co., 171 York St., Rochester 11, N. Y.
Harrington & King Perforating Co., 5634 Fillmore St., Chicago 44, Ill.
Hendrick Mfg. Co., 37 Dundaff St., Carbondale, Pa.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y.

PHENOL RECOVERY PLANTS

Koppers Co., Engineering and Construction Div., 300 Koppers Bldg., Pittsburgh 19, Pa.

PHOSPHOR BRONZE—See METALS (Nonferrous)

PHOTOGRAPHIC LIGHTING EQUIPMENT

Bardwell & McAlister, Inc., P. O. Box 1310, Hollywood 28, Cal.

PICKERS (Vacuum and Mechanical)

Littell, F. J., Machine Co., 4165 N. Ravenswood Ave., Chicago 13, Ill.

PICKLING

Hanlon-Gregory Galvanizing Co., 5515 Butler St., Pittsburgh 1, Pa.

PICKLING COMPOUNDS

American Chemical Paint Co., Ambler, Pa.
American Zinc, Lead & Smelting Co., 943 Paul Brown Bldg., St. Louis 1, Mo.
Cleveland Cliffs Iron Co., The, Union Commerce Bldg., Cleveland 14, O.

PICKLING COMPOUNDS (Con.)

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Kelite Products Inc., 909 E. 60th St., Los Angeles 1, Cal.
Oakite Products, Inc., 34E Thames St., New York 6, N. Y.
Pennsylvania Salt Mfg. Co., 1000 Widener Bldg., Philadelphia 7, Pa.
Turco Products, Inc., 6135 S. Central Ave., Los Angeles 54, Cal.

PICKLING EQUIPMENT

Alvey-Ferguson Co., The, 85 Disney St., Cincinnati 9, O.
Buffalo Wire Works Co., Inc., 437 Terrace Rd., Buffalo 2, N. Y.
International Nickel Co., Inc., The, 67 Wall St., New York 5, N. Y.
Meaker Co., The, 1635 S. 55th Ave., Chicago 50, Ill.
National Carbon Co., Inc., 30 E. 42nd St., New York 17, N. Y.
Ransohoff, N., Inc., 1317 Township Ave., Cincinnati 16, O.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Youngstown Welding & Eng. Co., 3711 Oakwood Ave., Youngstown 9, O.

PICKLING MACHINERY

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown 1, O.
Erie Foundry Co., Erie, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh 30, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Wean Engineering Co., Inc., The, Warren, O.
Youngstown Welding & Eng. Co., The, 3711 Oakwood Ave., Youngstown 9, O.

PICKLING TANK LININGS

Ceilcote Co., 750 Rockefeller Bldg., Cleveland 13, O.
Goodrich, B. F., Co., The, Akron, O.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.
National Carbon Co., Inc., 30 E. 42nd St., New York 17, N. Y.
National Lead Co., 111 Broadway, New York 6, N. Y.
Pennsylvania Salt Mfg. Co., 1000 Widener Bldg., Philadelphia 7, Pa.
United States Rubber Co., Mechanical Goods Div., 1230 Sixth Ave., New York 20, N. Y.

PICKLING TANKS—See TANKS (Pickling)

PIG CASTING MACHINES

Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh 22, Pa.

PIG IRON

Alan Wood Steel Co., Conshohocken, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Bethlehem Steel Co., Bethlehem, Pa.
Brooke, E. & G., Iron Co., Birdsboro, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Cleveland-Cliffs Iron Co., The, Union Commerce Bldg., Cleveland 14, 0.
Hanna Furnace Corp., The, Ecorse, Detroit 18, Mich.
Jackson Iron & Steel Co., Jackson, O.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Samuel, Frank & Co., Inc., Harrison Bldg., Philadelphia 2, Pa.
Shenango Furnace Co., Oliver Bldg., Pittsburgh 22, Pa.
Snyder, W. P., & Co., Oliver Bldg., Pittsburgh 22, Pa.
Wisconsin Steel Co., 180 N. Michigan Ave., Chicago 1, Ill.

PILING (Iron and Steel)

Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
National Tube Co., Frick Bldg., Pittsburgh 30, Pa.
Republic Steel Corp., Dept ST, Cleveland 4, O.

PILING (Pipe)

American Rolling Mill Co., The, 3361 Curtis St., Middletown, O.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
National Tube Co., Frick Bldg., Pittsburgh 30, Pa.
Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland 13, O.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

PILING (Pressure-Treated Wood)

Koppers Co., Wood Preserving Div., 300 Koppers Bldg., Pittsburgh 19, Pa.

PILLOW BLOCKS (Anti-Friction)

Dodge Manufacturing Corp., Mishawaka, Ind.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Medart Co., The, 3500 DeKalb St., St. Louis 18, Mo.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
SKF Industries, Inc., Front St. & Erie Ave., Philadelphia 34, Pa.

PILLOW BOXES

Norma-Hoffmann Bearings Corp., Stamford, Conn.

PINIONS (Mill)

Bethlehem Steel Co., Bethlehem, Pa.
Continental Foundry & Machine Co., E. Chicago, Ind.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland 14, O.
Lewis Fdry. & Mach. Div. of Blaw-Knox Co., Pittsburgh 30, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
Pittsburgh Steel Foundry Corp., Glassport, Pa.
Simonds Gear & Mfg. Co., The, 25th St., Pittsburgh 22, Pa.
United Engineering & Foundry Co., First National Bank Bldg., Pittsburgh 22, Pa.

PINS (Case Hardened or Heat Treated)

Ferry Cap & Set Screw Co., 2151 Scranton Rd., Cleveland 13, O.
U. S. Automatic Corp., Amherst, O.

PINS (Piston)

Burgess-Norton Mfg. Co., 778 Peyton St., Geneva, Ill.

PINS (Taper)

Chicago Screw Company, The, 1026 S. Homan Ave., Chicago 24, Ill.
Moltrup Steel Products Co., Beaver Falls, Pa.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.
U. S. Automatic Corp., Amherst, O.

PIPE (Alloy) (*Also Stainless)

*Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
*Youngstown Welding & Eng. Co., The, 3711 Oakwood Ave., Youngstown 9, O.

PIPE (Aluminum or Magnesium)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
Dow Chemical Co., The, Midland, Mich.

PIPE (Brass, Bronze or Copper)

American Brass Co., The, Waterbury 88, Conn.
Bridgeport Brass Co., Bridgeport 2, Conn.
Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
Revere Copper & Brass Co., Inc., 230 Park Ave., New York 17, N. Y.
Shenango-Penn Mold Co., 444 W. Third St., Dover, O.

PIPE (Cement Lined)

National Tube Co., Frick Bldg., Pittsburgh 30, Pa.

PIPE (Lead or Lead Lined)

National Lead Co., 111 Broadway, New York 6, N. Y.

PIPE (Non-Metallic)

National Carbon Co., Inc., 30 E. 42nd St., New York 17, N. Y.

PIPE (Rubber Lined)

Goodrich, B. F., Co., The, Akron, O.
United States Rubber Co., Mechanical Goods Div., 1230 Sixth Ave., New York 20, N. Y.

PIPE (Square and Rectangular)

Drake Steel Supply Co., 10660 S. Alameda St., Los Angeles 2, Cal.
National Tube Co., Frick Bldg., Pittsburgh 30, Pa.
Tubular Service Corp., 32 Broadway, New York 4, N. Y.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

PIPE (Steel)

Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
American Rolling Mill Co., The, 3361 Curtis St., Middletown, O.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco 6, Calif.
Consolidated Steel Corp., Ltd., 5700 S. Eastern Ave., Los Angeles 22, Cal.
Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
Drake Steel Supply Co., 10660 S. Alameda St., Los Angeles 2, Cal.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
National Tube Co., Frick Bldg., Pittsburgh 30, Pa.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Tubular Service Corp., 32 Broadway, New York 4, N. Y.
Wheeling Steel Corp., Wheeling W. Va.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

PIPE (Steel, Fabricated)

Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
Power Piping Div. of Blaw-Knox Co., Beaver & Western Ave., Pittsburgh 2, Pa.

PIPE BENDING

Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
Grinnell Co., Inc., Providence 1, R. I.
Power Piping Div. of Blaw-Knox Co., Beaver & Western Ave., Pittsburgh 2, Pa.
Tubular Service Corp., 32 Broadway, New York 4, N. Y.
Wallace Supplies Mfg. Co., 1306 Diversey Parkway, Chicago 14, Ill.

PIPE BENDING MACHINES

American Pipe Bending Machine Co., Inc., 37-39 Pearl St., Boston 10, Mass.
Pines Engineering Co., 600 Prairie St., Aurora, Ill.
Wallace Supplies Mfg. Co., 1306 Diversey Parkway, Chicago 14, Ill.

PIPE COUPLINGS

Dresser Mfg. Co., Bradford, Pa.

PIPE CUTTING AND THREADING MACHINERY

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown 1, O.
Landis Machine Co., Waynesboro, Pa.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland 3, O.
Murchey Machine & Tool Co., 951 Porter St., Detroit 26, Mich.
Pines Engineering Co., 600 Prairie St., Aurora, Ill.
Taylor-Wilson Mfg. Co., 15 Thomson Ave., McKees Rocks, Pa.

PIPE FITTINGS

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
Dresser Mfg. Co., Bradford, Pa.
Grinnell Co., Inc., Providence 1, R. I.

PIPE LINES (Riveted or Welded)

Bethlehem Steel Co., Bethlehem, Pa.
Brandt, Charles T., Inc., 1702 Ridgley St., Baltimore 30, Md.

PIPE MACHINING EQUIPMENT

Pines Engineering Co., 600 Prairie St., Aurora, Ill.

PIPE MILL MACHINERY

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown 1, O.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Taylor-Wilson Mfg. Co., 15 Thomson Ave., McKees Rocks, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh 22, Pa.
Yoder Co., The, 5500 Walworth Ave., Cleveland 2, O.

PIPE STRAIGHTENING MACHINERY

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg Youngstown 1, O.
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia 42, Pa.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee 10, Wis.
Medart Co., The, 3500 DeKalb St., St. Louis 18, Mo.
Taylor-Wilson Mfg. Co., 15 Thomson Ave., McKees Rocks, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh 22, Pa.

PIPE TOOLS

Detroit Tap & Tool Co., 8432 Butler St., Detroit 11, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Oster Mfg. Co., The, 2037 E. 61st., Cleveland 3, O.
Pines Engineering Co., 600 Prairie St., Aurora, Ill.

PIPING CONTRACTORS

Grinnell Co., Inc., Providence 1, R. I.
Power Piping, Div. of Blaw-Knox Co., Beaver and Western Ave., Pittsburgh 2, Pa.

PISTON RINGS

American Hammered Piston Ring Div., Koppers Co., Baltimore 3, Md.

PISTON RODS

Bliss & Laughlin, Inc., Harvey, Ill.
Finkl, A., & Sons Co., 2011 N. Southport Ave., Chicago 14, Ill.
Heppenstall Co., Dept. TP, 4620 Hatfield St., Pittsburgh 1, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago 50, Ill.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia 42, Pa.
Union Drawn Steel Div., Republic Steel Corp., Massillon, O.
Wyckoff Steel Co., P.O. Box 1256, Pittsburgh 30, Pa.

PLANERS

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia 42, Pa.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland 14, O.
Consolidated Machine Tool Corp., 565 Blossom Rd., Rochester 10, N. Y.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
Sellers, William, & Co., Inc., 1622 Hamilton St., Philadelphia 30, Pa.

PLANT DISMANTLERS

Hetz Construction Co., Warren, O.

PLATE CASTORS

Hyatt Bearings Div., General Motors Corp., Harrison, N. J.

PLATES (Aluminum or Magnesium)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
Dow Chemical Co., The, Midland, Mich.

PLATES (Sheared or Universal)
(*Also Stainless)

*Alan Wood Steel Co., Conshohocken, Pa.
*Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
American Petrometal Corp., Broadway at 11th St., Long Island City 2, N. Y.
*American Rolling Mill Co., The, Benedict-Miller Inc., 216 Clifford 3361 Curtis St., Middletown, O. St., Newark 5, N. J.
*Bethlehem Steel Co., Bethlehem, Pa.
*Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
*Columbia Steel Co., San Francisco 6, Calif.
Enterprise Galvanizing Co., 3525 E. Cumberland St., Philadelphia 25, Pa.
Granite City Steel Co., Granite City, Ill.
Holliday, W. J., & Co., Hammond, Ind.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago 4, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
International Nickel Co., Inc., The, 67 Wall St., New York 5, N. Y.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Levinson Steel Sales Co., The, 33 Pride St., Pittsburgh 19, Pa.
*Republic Steel Corp., Dept. ST, Cleveland 4, O.
*Ryerson, Jos. T., & Son, Inc., 16th and Rockwell Sts., Chicago 80, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham 2, Ala.
*United States Steel Supply Co., P. O. Box MM, Chicago 90, Ill.
Wisconsin Steel Co., 180 N. Michigan Ave., Chicago 1, Ill.
Worth Steel Co., Claymont, Del.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

PLATES (Stainless Clad)

Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago 4, Ill.
Jessop Steel Co., 584 Green St., Washington, Pa.

PLATES (Steel—Floor)—See FLOORING (Steel)

PLATES (Terne and Tin)—See TIN or TERNE PLATE

PLATING EQUIPMENT

Brandt, Charles T., Inc., 1702 Ridgley St., Baltimore 30, Md.
Chicago Wheel & Mfg. Co., Dept. ST, 1101 W. Monroe St., Chicago 7, Ill.
Federal Telephone & Radio Corp., Div. International Telephone & Telegraph Corp., 32 Central Ave., Newark 1, N. J.
Hall, C. M., Lamp Co., 1005 E. Hancock St., Detroit 7, Mich.
Heil Engineering Co., 12903 Elmwood Ave., Cleveland 11, O.
Meaker Co., The, 1635 S. 55th Ave., Chicago 50, Ill.
Siefen, J. J., Co., 5657 Lauderdale Ave., Detroit 9, Mich.
Udylite Corp., The, 1651 E. Grand Blvd., Detroit 11, Mich.

PLATING SUPPLIES

Turco Products, Inc., 6135 S. Central Ave., Los Angeles 54, Cal.
United Chromium, Inc., 51 E. 42nd St., New York 17, N. Y.

PLUGS (Expansion)

Hubbard, M. D., Spring Co., 410 Central Ave., Pontiac 12, Mich.
Master Products Co., 6400 Park Ave., Cleveland 5, O.
Wrought Washer Mfg. Co., 2103 S. Bay St., Milwaukee 7, Wis.

POLE LINE MATERIAL

Bethlehem Steel Co., Bethlehem, Pa.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh 3, Pa.

POLES (Tubular Steel)

Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
National Tube Co., Frick Bldg., Pittsburgh 30, Pa.

PORTABLE TOOLS AND ACCESSORIES

Chicago Wheel & Manufacturing Co., Dept. ST, 1101 W. Monroe St., Chicago 7, Ill.
Dumore Co., The, 1225 14th St., Racine, Wis.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Lewthwaite, T. H., Machine Co., Inc., 311 E. 47th St., New York 17, N. Y.
Syntron Co., 370 Lexington Ave., Homer City, Pa.

POTENTIOMETERS

Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia 44, Pa.
Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.

POTS (Annealing-Wire)

National Annealing Box Co., Washington, Pa.

POTS (Case Hardening)

Holden, A. F., Co., The, P. O. Box 1898, New Haven 8, Conn.
Rolock, Inc., 1380 Kings Highway, Fairfield, Conn.
Tate-Jones & Co., Inc., Leetsdale, Pa.

POTS (Melting)

Farrel-Birmingham Co., Inc., Ansonia, Conn.
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore 2, Md.

POTS (Tinning)

National Annealing Box Co., Washington, Pa.

POWDERS, METAL (Iron, Lead, Copper)

Metals Refining Co., Div. of The Glidden Co., 1717 Summer St., Hammond, Ind.

POWDERED METAL PRODUCTS

Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.
Moraine Products Div., General Motors Corp., Dayton 1, O.

POWER PLANTS (Diesel, Gas Engine, Steam)

Ready-Power Co., The, 3842 Grand River Ave., Detroit 8, Mich.

POWER UNITS (Gasoline, Electric, for Industrial Trucks)

Ready-Power Co., The, 3842 Grand River Ave., Detroit 8, Mich.

PREHEATERS

Babcock & Wilcox Co., The, 85 Liberty St., New York 6, N. Y.
Fostoria Pressed Steel Corp., The, Fostoria, O.
Hall, C. M., Lamp Co., 1005 E. Hancock St., Detroit 7, Mich.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Tate-Jones & Co., Inc., Leetsdale, Pa.

PRESS BRAKES

Cincinnati Shaper Co., The, Garrard and Elam Sts., Cincinnati 25, O.
Cleveland Crane & Engineering Co., The, Steelweld Machinery Div., The, 1125 E. 283rd St., Wickliffe, O.

PRESSED METAL PARTS

American Brass Co., The, Waterbury 88, Conn.
Brandt, Charles T., Inc., 1702 Ridgley St., Baltimore 30, Md.
Mullins Mfg. Co., Warren, O.
Stanley Works, The, Pressed Metal Div., New Britain, Conn.
Worcester Pressed Steel Co., 508 Barber Ave., Worcester 6, Mass.

PRESSES

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia 42, Pa.
Beatty Machine & Mfg. Co., Hammond, Ind.
Birdsboro Steel Fdry. & Machine Co., Birdsboro, Pa.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland 14, O.
Colonial Broach Co., P.O. Box No. 37, Harper Sta., Detroit 7, Mich.
Denison Engineering Co., The, 1163 Dublin Rd., Columbus 16, O.
Erie Foundry Co., Erie, Pa.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Galland-Henning Manufacturing Co., 2747 S. 31st St., Milwaukee 7, Wis.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee 10, Wis.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo 11, N. Y.
Streine Tool & Mfg. Co., The, New Bremen, O.
Taylor-Wilson Mfg. Co., 15 Thomson Ave., McKees Rocks, Pa.
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh 23, Pa.
Tomkins-Johnson Co., The, Dept. S, 611 N. Mechanic St., Jackson, Mich.

PRESSES (Bending)

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia 42, Pa.
Beatty Machine & Mfg. Co., Hammond, Ind.
Birdsboro Steel Fdry. & Machine Co., Birdsboro, Pa.
Cleveland Crane & Engineering Co., The, Steelweld Machinery Div., The, 1125 E. 283rd St., Wickliffe, O.
Denison Engineering Co., The, 1163 Dublin Rd. Columbus 16, O.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
Zeh & Hahnemann Co., 56 Avenue A, Newark 5, N. J.

PRESSES (Extrusion)

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia 42, Pa.
Beatty Machine & Mfg. Co., Hammond, Ind.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Hydraulic Press Mfg. Co., The, Mt. Gilead, O.
Hydropress, Inc., 570 Lexington Ave., New York 22, N. Y.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
Schloemann Engineering Corp., 1105 Empire Bldg., Pittsburgh 22, Pa.

PRESSES (Forging)

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia 42, Pa.
Birdsboro Steel Fdry. & Machine Co., Birdsboro, Pa.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland 14, O.
Erie Foundry Co., Erie, Pa.
Hydraulic Press Mfg. Co., The, Mt. Gilead, O.
Hydropress, Inc., 570 Lexington Ave., New York 22, N. Y.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
Morgan Engineering Co., The, Alliance, O.
National Machinery Co., The, Tiffin, O.
Schloemann Engineering Corp., 1105 Empire Bldg., Pittsburgh 22, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh 22, Pa.

PRESSES (Forming and Braking)

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia 42, Pa.
Beatty Machine & Mfg. Co., Hammond, Ind.
Cincinnati Shaper Co., The, Garrard and Elam Sts., Cincinnati 25, O.
Cleveland Crane & Engineering Co., The, Steelweld Machinery Div., The, 1125 E. 283rd St., Wickliffe, O.
Hydraulic Press Mfg. Co., The Mt. Gilead, O.
Zeh & Hahnemann Co., 56 Avenue A, Newark 5, N. J.

PRESSES (Hydraulic)

Air Hydraulics Div., Beyer Machine Co., Jackson, Mich.
Albert, L., & Son, Whitehead Rd., Trenton, N. J.
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia 42, Pa.
Beatty Machine & Mfg. Co., Hammond, Ind.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Chambersburg Engineering Co., Chambersburg, Pa.
Colonial Broach Co., P.O. Box No. 37, Harper Sta., Detroit 7, Mich.
Denison Engineering Co., The, 1163 Dublin Rd., Columbus 16, O.
Erie Foundry Co., Erie, Pa.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Galland-Henning Manufacturing Co., 2747 S. 31st St., Milwaukee 7, Wis.
Hanna Engineering Works, 1765 Elston Ave., Chicago 22, Ill.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago 24, Ill.
Hydraulic Press Mfg. Co., The, Mt. Gilead, O.
Hydropress, Inc., 570 Lexington Ave., New York 22, N. Y.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee 10, Wis.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
Morgan Engineering Co., The, Alliance, O.
Progressive Welder Co., 3050 E. Outer Drive, Detroit 12, Mich.
Schloemann Engineering Corp., 1105 Empire Bldg., Pittsburgh 22, Pa.
Taylor-Wilson Mfg. Co., 15 Thomson Ave., McKees Rocks, Pa.
Wood, R. D., Co., 400 Chestnut St., Philadelphia 5, Pa.
Wright Mfg. Div. of American Chain & Cable Co., Inc., York, Pa.

PRESSES (Pneumatic)

Air Hydraulics Div., Beyer Machine Co., Jackson, Mich.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago 24, Ill.

PRESSES (Punching, Drawing, Coining, Blanking, etc.)

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia 42, Pa.
Beatty Machine & Mfg. Co., Hammond, Ind.
Birdsboro Steel Fdry. & Machine Co., Birdsboro, Pa.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland 14, O.
Hydraulic Press Mfg. Co., The, Mt. Gilead, O.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo 11, N. Y.
Progressive Welder Co., 3050 E. Outer Drive, Detroit 12, Mich.
Zeh & Hahnemann Co., 56 Avenue A, Newark 5, N. J.

PRESSES (Riveting)

Hanna Engineering Works, 1765 Elston Ave., Chicago 22, Ill.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago 24, Ill.

PRESSES (Stamping)

Hydraulic Press Mfg. Co., The, Mt. Gilead, O.
Matthews, Jas. H., & Co., 3978 Forbes St., Pittsburgh 13, Pa.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo 11, N. Y.
Zeh & Hahnemann Co., 56 Avenue A, Newark 5, N. J.

PRESSES, BRIQUETTING (Hydraulic)

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia 42, Pa.
Hydraulic Press Mfg. Co., The, Mt. Gilead, O.
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee 4, Wis.

PRESSURE VESSELS

Babcock & Wilcox Co., 85 Liberty St., New York 6. N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Blaw-Knox Div. of Blaw-Knox Co., Blawnox, Pa.
Consolidated Steel Corp., Ltd., 5700 S. Eastern Ave., Los Angeles 22, Cal.
National Annealing Box Co., Washington, Pa.
Scaife Co., Ann St., Oakmont, Pa.
Struthers Wells Corp., Titusville, Pa.

PROCESS ENGINEERING

Acme Pattern & Tool Co., Inc., 232 Findlay St., Dayton 3, O.

PUG MILLS

Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh 22, Pa.

PULLEYS (Magnetic)

Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee 1, Wis.

PULVERIZERS

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
American Pulverizer Co., 1539 Macklind Ave., St. Louis 10, Mo.
Babcock & Wilcox Co., The, 85 Liberty St., New York 6. N. Y.
Vulcan Iron Works, Wilkes-Barre, Pa.

PUMPHOUSES

Dravo Corp., (Contracting Div.), Neville Island, Pittsburgh 25, Pa.

PUMPS

Aldrich Pump Co., The, 8 Pine St., Allentown, Pa.
Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Fairbanks, Morse & Co., Fairbanks-Morse Bldg., Chicago 5, Ill.
Hydropress, Inc., 570 Lexington Ave., New York 22, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
Oil Well Supply Co., Dallas 1, Tex.
Pesco Products Co., 11610 Euclid Ave., Cleveland 6, O.
Romec Pump Co., Elyria, O.
Weinman Pump & Supply Co., The, 207-209 Blvd. of the Allies, Pittsburgh 22, Pa.

PUMPS (Boiler Feed)

Aldrich Pump Co., The, 8 Pine St., Allentown, Pa.
Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Fairbanks, Morse & Co., Fairbanks-Morse Bldg., Chicago 5, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

PUMPS (Centrifugal)

Aldrich Pump Co., The, 8 Pine St., Allentown, Pa.
Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Brown & Sharpe Mfg. Co., Providence 1, R. I.
Fairbanks, Morse & Co., Fairbanks-Morse Bldg., Chicago 5, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
National Carbon Co., Inc., 30 E. 42nd St., New York 17, N. Y.
Pesco Products Co., 11610 Euclid Ave., Cleveland 6, O.
Romec Pump Co., Elyria, O.
Schneible, Claude B., Co., 2827 25th St., Detroit 16, Mich.

PUMPS (Fuel Injection)

Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit 6, Mich.

PUMPS (High Pressure)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Hydropress, Inc., 570 Lexington Ave., New York 22, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

PUMPS (Hydraulic)

Aldrich Pump Co., The, 8 Pine St., Allentown, Pa.
Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia 42, Pa.
Brown & Sharpe Mfg. Co., Providence 1, R. I.
Denison Engineering Co., The, 1163 Dublin Rd., Columbus 16, O.
Galland-Henning Manufacturing Co., 2747 S. 31st St., Milwaukee 7, Wis.
Hydraulic Press Mfg. Co., The, Mt. Gilead, O.
Hydropress, Inc., 570 Lexington Ave., New York 22, N. Y.
Logemann Brothers Co., 3126 Burleigh St., Milwaukee 10, Wis.
Lyon-Raymond Corp., Greene, N. Y.
Pesco Products Co., 11610 Euclid Ave., Cleveland 6, O.
Romec Pump Co., Elyria, O.
Schloemann Engineering Corp., 1105 Empire Bldg., Pittsburgh 22, Pa.
Sundstrand Machine Tool Co., 2540 Eleventh St., Rockford, Ill.
Vickers Inc., 1480 Oakman Blvd., Detroit 32, Mich.
Wood, R. D., Co., 400 Chestnut St., Philadelphia 5, Pa.

PUMPS (Lubricating)

Nichols, W. H., and Sons, Waltham 54, Mass.

PUMPS (Metering)

Nichols, W. H., and Sons, Waltham 54, Mass.

PUMPS (Pressure)

Nichols, W. H., and Sons, Waltham 54, Mass.

PUMPS (Reciprocating)

Aldrich Pump Co., The, 8 Pine St., Allentown, Pa.
Fairbanks, Morse & Co., Fairbanks-Morse Bldg., Chicago 5, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Pesco Products Co., 11610 Euclid Ave., Cleveland 6, O.
Romec Pump Co., Elyria, O.

PUMPS (Rotary)

Brown & Sharpe Mfg. Co., Providence 1, R. I.
Fairbanks, Morse & Co., Fairbanks-Morse Bldg., Chicago 5, Ill.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago 6, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Nichols, W. H., and Sons, Waltham 54, Mass.
Pesco Products Co., 11610 Euclid Ave., Cleveland 6, O.
Romec Pump Co., Elyria, O.
Vickers, Inc., 1480 Oakman Blvd., Detroit 32, Mich.

PUMPS (Vacuum)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Pesco Products Co., 11610 Euclid Ave., Cleveland 6, O.
Romec Pump Co., Elyria, O.

PUMPS (Vertical Turbine)

Fairbanks, Morse & Co., Fairbanks-Morse Bldg., Chicago 5, Ill.
Layne & Bowler, Inc., Memphis 8, Tenn.

PUNCHES (Multiple)

Beatty Machine & Mfg. Co., Hammond, Ind.
Cincinnati Shaper Co., The, Garrand and Elam Sts., Cincinnati 25, O.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland 14, O.
Consolidated Machine Tool Corp., 565 Blossom Rd., Rochester 10, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago 24, Ill.
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh 23, Pa.
Wales Strippit Corp., 385 Payne Ave., N. Tonawanda, N. Y.

PUNCHING AND SHEARING MACHINERY

Beatty Machine & Mfg. Co., Hammond, Ind.
Buffalo Forge Co., 158 Mortimer St., Buffalo 5, N. Y.
Chambersburg Engineering Co., Chambersburg, Pa.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland 14, O.
Consolidated Machine Tool Corp., 565 Blossom Rd., Rochester 10, N. Y.
Continental Foundry & Machine Co., E. Chicago, Ind.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago 24, Ill.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh 30, Pa.
Morgan Engineering Co., The, Alliance, O.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo 11, N. Y.
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh 23, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh 22, Pa.
Wean Engineering Co., Inc., The, Warren, O.

PYROMETER TUBES

Carborundum Co., The, Niagara Falls, N. Y.
Norton Company, Worcester 6, Mass.

PYROMETERS

Brown Instrument Co., The, Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia 44, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia 44, Pa.

RACKS & PINIONS

Industrial Gear Mfg. Co., 4545 W. Van Buren St., Chicago 24, Ill.

RAIL BREAKERS

National Roll & Foundry Co., The, Avonmore, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh 22, Pa.

RAILS (New and Relaying)

Drake Steel Supply Co., 10660 S. Alameda St., Los Angeles 2, Cal.
Dulien Steel Products, Inc., 414 First Ave. S., Seattle, Wash.
Foster, L. B., Co., Inc., P. O. Box 1647, Pittsburgh, Pa.
Sonken-Galamba Corp., 108 N. 2nd St., Kansas City, Kans.

RAILS (Steel)

Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham 2, Ala.
United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.
Weirton Steel Co., Weirton, W. Va.

REAMERS

Black Drill Co., 1400 E. 222nd St., Cleveland 17, O.
Brown & Sharpe Mfg. Co., Providence 1, R. I.
Carboloy Co., Inc., 11141 E. 8 Mile Blvd., Detroit 32, Mich.
Cleveland Twist Drill Co., The, 1242 E. 49th St., Cleveland 14, O.
Genesee Tool Co., Fenton, Mich.
Gisholt Machine Co., 1217 E. Washington Ave., Madison 3, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., 30 E. 42nd St., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Scully-Jones & Co., 1901 S. Rockwell St., Chicago 8, Ill.

REBUILT EQUIPMENT

Albert, L., & Son, Whitehead Rd., Trenton, N. J.
General Blower Co., 404 N. Peoria St., Chicago 22, Ill.
Iron & Steel Products, Inc., Hegewisch Sta., Chicago 33, Ill.
West Penn Machinery Co., 1208 House Bldg., Pittsburgh, Pa.

RECEIVERS

Scaife Co., Ann St., Oakmont, Pa.

RECORD FORMS

Remington-Rand Inc., Systems Div., 499 Washington St., Buffalo 3, N. Y.
United Autographic Register Co., 5000 S. California Ave., Chicago 32, Ill.

RECORD KEEPING SYSTEMS

Diebold Incorporated, 818 Mulberry Rd., Canton 2, O.
Remington-Rand Inc., Systems Div., 499 Washington St., Buffalo 3, N. Y.
United Autographic Register Co., 5000 S. California Ave., Chicago 32, Ill.

RECORDERS (Combustion)

Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia 44, Pa.

RECORDERS (Pressure, Speed, Temperature, Time)

Brown Instrument Co., The, Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia 44, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia 44, Pa.

RECTIFIERS (Dry Disc)

Federal Telephone & Radio Corp., Div. International Telephone & Telegraph Corp., 32 Central Ave., Newark 1, N. J.
General Electric Co., Sec. A 443-90, Tungar & Metallic Rectifier Div., Bridgeport 2, Conn.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.
Meaker Co., The, 1635 S. 55th Ave., Chicago 50, Ill.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

RECTIFIERS (Mercury Arc)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Federal Telephone & Radio Corp., Div. International Telephone & Telegraph Corp., 32 Central Ave., Newark 1, N. J.
General Electric Co., Schenectady 5, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

REDUCTION GEARS

Farrel-Birmingham Co., Inc., Ansonia, Conn.
Foote Bros. Gear & Machine Co., 5225 S. Western Blvd., Chicago 9, Ill.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland 14, O.
James, D. O., Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia 40, Pa.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Philadelphia Gear Works, Erie Ave., & G St., Philadelphia 34, Pa.
Sturtevant, B. F., Co., Hyde Park, Boston 36, Mass.
Twin Disc Clutch Co., 1379 Racine Ave., Racine, Wis.
Westinghouse Electric & Mfg. Co., 200 McCandless Ave., Pittsburgh 1, Pa.

REELS (Automatic Centering)

Littell, F. J., Machine Co., 4165 N. Ravenswood Ave., Chicago 13, Ill.

REFRACTORIES (Chrome)

Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.

REFRACTORIES (Dolomite)

Basic Refractories, Inc., Hanna Bldg., Cleveland 15, O.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.

REFRACTORIES (Fire Clay)

Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York 6, N. Y.
Electro Refractories & Alloys Corp. Vars Bldg., Buffalo 2, N. Y.
Eureka Fire Brick Works, 1100 B. F. Jones Law Bldg., Pittsburgh 19, Pa.
Globe Brick Co., The, East Liverpool, O.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.
Illinois Clay Products Co., 214 Barber Bldg., Joliet, Ill.
National Fireproofing Corp., 202 E. Ohio St., Pittsburgh 12, Pa.
Remmey, Richard C., Son Co., Hedley St. & Delaware River, Philadelphia 37, Pa.

REFRACTORIES (For High Frequency Furnaces)

Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York 6, N. Y.
Carborundum Co., The, Perth Amboy, N. J.
Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.
Johns-Manville Corp., 22 E. 40th St., New York 16, N. Y.
Norton Co., Worcester 6, Mass.

REFRACTORIES (Forsterite)

Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.

REFRACTORIES (High Alumina)

Carborundum Co., The, Niagara Falls, N. Y.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.

REFRACTORIES (Insulating)

Carborundum Co., The, Niagara Falls, N. Y.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.
Johns-Manville Corp., 22 E. 40th St., New York 16, N. Y.

REFRACTORIES (Magnesia)

Basic Refractories, Inc., Hanna Bldg., Cleveland 15, O.
Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.

REFRACTORIES (Magnesite)

Basic Refractories, Inc., Hanna Bldg., Cleveland 15, O.
Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.

REFRACTORIES (Plastic)

Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York 6, N. Y.
Basic Refractories, Inc., Hanna Bldg., Cleveland 15, O.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.
Johns-Manville Corp., 22 E. 40th St., New York 16, N. Y.
Products Mfg. Co., 513 E. Buffalo St., Milwaukee 2, Wis.
Remmey, Richard C., Son Co., Hedley St. & Delaware River, Philadelphia 37, Pa.

REFRACTORIES (Silica)

Carborundum Co., The, Niagara Falls, N. Y.
Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.

REFRACTORIES (Silicon Carbide)

Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., The, Perth Amboy, N. J.
Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.
Norton Co., Worcester 6, Mass.
Remmey, Richard C., Son Co., Hedley St. & Delaware River, Philadelphia 37, Pa.

REFRACTORY CEMENT AND CONCRETE

Atlas Lumnite Cement Co., Dept. S., Chrysler Bldg., New York 17, N. Y.
Babcock & Wilcox Co., The, Refractories Div., 85 Liberty St., New York 6, N. Y.
Carborundum Co., The, Niagara Falls, N. Y.
Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Harbison-Walker Refractories Co., 1800 Farmers Bank Bldg., Pittsburgh 22, Pa.

REFRACTORY CEMENT and CONCRETE—Con.

Johns-Manville Corp., 22 E. 40th St., New York 16, N. Y.
National Fireproofing Corp., 202 E. Ohio St., Pittsburgh 12, Pa.
Remmey, Richard C., Son Co., Hedley St. & Delaware River, Philadelphia 37, Pa.

REFRIGERATION EQUIPMENT (Industrial)

General Electric Co., (Air Conditioning & Commercial Refrigeration Div., Sec. 4412), Bloomfield, N. J.
Kold-Hold Mfg. Co., 444 N. Grand Ave., Lansing 4, Mich.

REGULATORS (Pressure)

Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee 1, Wis.
Electric Controller & Mfg. Co., The, 2698 E. 79th St., Cleveland 4, O.
Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.
Square D Co., 6060 Rivard St., Detroit 11, Mich.
Victor Equipment Co., 844-54 Folsom St., San Francisco 7, Cal.

REGULATORS (Temperature)

Brown Instrument Co., The, Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia 44, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia 44, Pa.

REGULATORS (Voltage)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Clark Controller Co., The, 1146 E. 152nd St., Cleveland 10, O.
General Electric Co., Schenectady 5, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Ward Leonard Electric Co., 65 South St., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

REGULATORS (Welding & Cutting)

Air Reduction, 60 E. 42nd St., New York 17, N. Y.
Linde Air Products Co., The, 30 E. 42nd St., New York 17, N. Y.
Victor Equipment Co., 844-54 Folsom St., San Francisco 7, Cal.

REINFORCEMENT FABRIC (Electric Welded)

American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Bethlehem Steel Co., Bethlehem, Pa.
Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh 30, Pa.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y.

RELAYS (Magnetic)

Clark Controller Co., The, 1146 E. 152nd St., Cleveland 10, O.
Square D Co., 4041 N. Richards St., Milwaukee 12, Wis.
Ward Leonard Electric Co., 65 South St., Mt. Vernon, N. Y.

RESISTORS (Alloy Grid or Wire Wound—Electric)

Clark Controller Co., The, 1146 E. 152nd St., Cleveland 10, O.
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee 1, Wis.
Electric Controller & Mfg. Co., The, 2698 E. 79th St., Cleveland 4, O.
General Electric Co., Schenectady 5, N. Y.
Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.
Square D Co., 4041 N. Richards St., Milwaukee 12, Wis.
Ward Leonard Electric Co., 65 South St., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

RESISTORS (Graphite Disc)

Allen-Bradley Co., 1316 S. 2nd St., Milwaukee 4, Wis.

RHEOSTATS

Clark Controller Co., The, 1146 E. 152nd St., Cleveland 10, O.
Electric Controller & Mfg. Co., The, 2698 E. 79th St., Cleveland 4, O
Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.
Udylite Corp., The, 1651 E. Grand Blvd., Detroit 11, Mich.
Ward Leonard Electric Co., 65 South St., Mt. Vernon, N. Y.

RINGS (Aluminum, Brass, Bronze)

Dresser Mfg. Co., Bradford, Pa.
Shenango-Penn Mold Co., 444 W. Third St., Dover, O.

RINGS (Steel)

American Welding & Mfg. Co., The Warren, O.
Commercial Forgings Co., The, 3700 E. 91st St., Cleveland 5, O.
Dresser Mfg. Co., Bradford, Pa.
Heppenstall Co., Dept. TP, 4620 Hatfield St., Pittsburgh 1, Pa.
King Fifth Wheel Co., 2915 N. Second St., Philadelphia 33, Pa.
Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago 50, Ill.
Midvale Co., The, Nicetown, Philadelphia 40, Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Standard Products Co., The, 505 Boulevard Bldg., Detroit 2, Mich.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia 42, Pa.

RINGS (Weldless) (*Also Stainless)

Commercial Forgings Co., The, 3700 E. 91st St., Cleveland 5, O.
*Midvale Co., The, Nicetown, Philadelphia 40, Pa.

RIVETERS (Hydraulic—Portable and Stationary)

Hanna Engineering Works, 1765 Elston Ave., Chicago 22, Ill.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago 24, Ill.

RIVETERS (Pneumatic)

Cleveland Pneumatic Tool Co., The, 3781 E. 77th St., Cleveland 5, O.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago 24, Ill.
Hanna Engineering Works, 1765 Elston Ave., Chicago 22, Ill.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago 6, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

RIVETING MACHINERY

Chambersburg Engineering Co., Chambersburg, Pa.
Hanna Engineering Works, 1765 Elston Ave., Chicago 22, Ill.
Tomkins-Johnson Co., The, Dept. S, 611 N. Mechanic St., Jackson, Mich.
Wood, R. D., Co., 400 Chestnut St., Philadelphia 5, Pa.

RIVETS (*Also Stainless)

Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh - Chicago
Champion Rivet Co., The, 11200 Harvard Ave., Cleveland 5, O.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.
*Harper, H. M., Co., The, 2646 Fletcher St., Chicago 18, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
*National Screw & Mfg. Co., The, 2440 E. 75th St., Cleveland 4, O.
*Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh 3, Pa.
*Republic Steel Corp., Upson Nut Div., Dept. ST, 1912 Scranton Rd., Cleveland 13, O.
*Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
*Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.
Triplex Screw Co., The, 5341 Grant Ave., Cleveland 5, O.

RIVETS (Nonferrous)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.
Harper, H. M., Co., The, 2646 Fletcher St., Chicago 18, Ill.
National Screw & Mfg. Co., The, 2440 E. 75th St., Cleveland 4, O.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.

RODS (Alloy)

American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Ampco Metal Inc., Dept. S-11, Milwaukee 4, Wis.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss & Laughlin, Inc., Harvey, Ill.
Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
Copperweld Steel Co., Warren, O.
International Nickel Co., Inc., The, 67 Wall St., New York 5, N. Y.
Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh 30, Pa.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.

RODS (Aluminum or Magnesium)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
Bohn Aluminum & Brass Corp., Lafayette Bldg., Detroit 26, Mich.
Dow Chemical Co., The, Midland, Mich.
Titan Metal Mfg. Co., Bellefonte, Pa.

RODS (Brass, Bronze, Phosphor Bronze, Silicon Bronze, Copper, Nickel Silver)

American Brass Co., The, Waterbury 88, Conn.
Bridgeport Brass Co., Bridgeport 2, Conn.
Bristol Brass Corp., The, Bristol, Conn.
Revere Copper & Brass Co., Inc., 230 Park Ave., New York 17, N. Y.
Roebling's, John A., Sons Co., Trenton 2, N. J.
Seymour Manufacturing Co., The, 51 Franklin St., Seymour, Conn.
Titan Metal Mfg. Co., Bellefonte, Pa.

RODS (Drill)

Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
Anchor Drawn Steel Co., Latrobe, Pa.
Benedict-Miller Inc., 216 Clifford St., Newark 5, N. J.
Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
Craine-Schrage Steel Co., 1025 S. Oakwood Ave., Detroit 25, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Jessop Steel Co., 584 Green St., Washington, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis 7, Ind.
Purdy, A. R., Co., 790 Greenwich St., New York 14, N. Y.
Sandvik Steel, Inc., 111 Eighth Ave., New York 11, N. Y.
United States Steel Supply Co., P. O. Box MM, Chicago 90, Ill.

RODS (Iron and Steel)

American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Bethlehem Steel Co., Bethlehem, Pa.

RODS (Iron & Steel) (Con.)

Buffalo Bolt Co., 101 East Ave., N. Tonawanda, N. Y.
Firth-Sterling Steel Co., McKeesport, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Roebling's, John A., Sons Co., Trenton 2, N. J.
United States Steel Supply Co., P. O. Box MM, Chicago 90, Ill.

RODS (Rounds, Flats and Shapes) (*Also Stainless)

*Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
*American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
*Copperweld Steel Co., Warren, O.
*Follansbee Steel Corp., Third & Liberty Sts., Pittsburgh 30, Pa.
*Firth-Sterling Steel Co., McKeesport, Pa.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
International Nickel Co., Inc., The, 67 Wall St., New York 5, N. Y.
*Jessop Steel Co., 584 Green St., Washington, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Levinson Steel Sales Co., The, 33 Pride St., Pittsburgh 19, Pa.
*Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh 30, Pa.
*Republic Steel Corp., Dept. ST, Cleveland 4, O.
Roebling's, John A., Sons Co., Trenton 2, N. J.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton 6, O.
Washburn Wire Co., Phillipsdale, R. I.
Wisconsin Steel Co., 180 N. Michigan Ave., Chicago 1, Ill.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

RODS (Wire)—See WIRE PRODUCTS

ROLL FORMING MACHINES

Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo 11, N. Y.
Wean Engineering Co., Inc., The, Warren, O.
Yoder Co., The, 5500 Walworth Ave., Cleveland 2, O.

ROLL HEATERS—See HEATERS (Electric Roll)

ROLLING DOORS & SHUTTERS—See DOORS AND SHUTTERS

ROLLING MILL BEARINGS—See BEARINGS (Rolling Mill)

ROLLING MILL ENGINEERS (Consulting and Contracting)

Hydropress, Inc., 570 Lexington Ave., New York 22, N. Y.
Schloemann Engineering Corp., 1105 Empire Bldg., Pittsburgh 22, Pa.

ROLLING MILL EQUIPMENT

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown 1, O.
Alliance Machine Co., The, Alliance, O.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Cold Metal Products Co., The, 2131 Wilson Ave., Youngstown 1, O.
Continental Foundry & Machine Co., E. Chicago, Ind.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Hyde Park Fdry. & Mach. Co., Hyde Park, Pa.
Hydropress, Inc., 570 Lexington Ave., New York 22, N. Y.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh 30, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh 3, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
Morgan Construction Co., Worcester 5, Mass.
Morgan Engineering Co., The, Alliance, O.
National Roll & Foundry Co., The, Avonmore, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Streine Tool & Mfg. Co., The, New Bremen, O.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh 22, Pa.
Wean Engineering Co., Inc., The, Warren, O.

ROLLING MILL MACHINERY (Used)

Foster, Frank B., Oliver Bldg., Pittsburgh, Pa.

ROLLING MILL TABLES AND ROLLERS

Hydropress, Inc., 570 Lexington Ave., New York 22, N. Y.
Schloemann Engineering Corp., 1105 Empire Bldg., Pittsburgh 22, Pa.

ROLLS (Bending and Straightening)

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia 42, Pa.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland 14, O.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago 24, Ill.
Medart Co., The 3500 DeKalb St., St. Louis 18, Mo.
Wean Engineering Co., Inc., The, Warren, O.
Webb Corp., The, Webb City, Mo.

ROLLS (Crushing)

Vulcan Iron Works, Wilkes-Barre, Pa.

ROLLS (Iron and Steel)

Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Commercial Forgings Co., The, 3700 E. 91st St., Cleveland 5, O.
Continental Foundry & Machine Co., E. Chicago, Ind.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Hyde Park Fdry. and Machine Co., Hyde Park, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh 30, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh 3, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
Midvale Co., The, Nicetown, Philadelphia 40, Pa.
National Roll & Fdry. Co., The, Avonmore, Pa.
Ohio Steel Foundry Co., Lima, O., Springfield, O.
Pittsburgh Rolls Div., Blaw-Knox Co., Pittsburgh 1, Pa.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh 22, Pa.

ROLLS (Nonferrous)

Shenango-Penn Mold Co., 444 W. Third St., Dover, O.

ROLLS (Sand and Chilled)

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown 1, O.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Continental Foundry & Machine Co., E. Chicago, Ind.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Hyde Park Fdry. & Mach. Co., Hyde Park, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh 30, Pa.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh 3, Pa.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
National Roll & Foundry Co., The, Avonmore, Pa.
Ohio Steel Foundry Co., Lima, O.-Springfield, O.
Pittsburgh Rolls Div. of Blaw-Knox Co., Pittsburgh 1, Pa.
United Engineering & Fdry Co., First National Bank Bldg., Pittsburgh 22, Pa.

ROLLS (Tinning Machine)

American Shear Knife Co., P. O. Box 355, Homestead, Pa.
Wean Engineering Co., Inc., The, Warren, O.

ROOFING, SIDING & FLASHING

Bethlehem Steel Co., Bethlehem, Pa.
Johns-Manville Corp., 22 E. 40th St., New York 16, N. Y.
Mahon, R. C., Co., The, 8650 Mt. Elliott Ave., Detroit 11, Mich.
Protected Steel Products Co., 33 Pride St., Pittsburgh 19, Pa.
Reeves Steel & Mfg. Co., Dover, O.

ROOFING AND SIDING (Corrugated and Plain)

American Rolling Mill Co., The, 3361 Curtis St., Middletown, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco 6, Calif.
Continental Steel Corp., Kokomo, Ind.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
Levinson Steel Sales Co., The, 33 Pride St., Pittsburgh 19, Pa.
New Jersey Zinc Co., 160 Front St., New York 7, N. Y.
Reeves Steel & Mfg. Co., Dover O.
Reliance Steel Corp. Div. Detroit Steel Corp., 1025 S. Oakwood Ave., Detroit 25, Mich.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Ryerson, Jos. T., & Sons, Inc., 16th and Rockwell Sts., Chicago 80, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham 2, Ala.
Weirton Steel Co., Weirton, W. Va.

ROOFING (Plastic and Liquid)

Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh 19, Pa.

ROTARY CONVERTERS

Kato Engineering Co., Mankato, Minn.

RUBBER GOODS (Industrial)

Boston Woven Hose & Rubber Co., P.O. Box 1071, Boston 3, Mass
Gates Rubber Co., The, 999 S. Broadway, Denver 17, Colo.
Goodrich, B. F., Co., The, Akron, O.
Standard Products Co., The, 505 Boulevard Bldg., Detroit 2, Mich.
United States Rubber Co., Mechanical Goods Div., 1230 Sixth Ave., New York 20, N. Y.

RUBBER LINING (Hard and Soft)

United States Rubber Co., Mechanical Goods Div., 1230 Sixth Ave., New York 20, N. Y.

RUST PREVENTIVES

American Chemical Paint Co., Ambler, Pa.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
International Rustproof Corp., 12507 Plover Ave., Lakewood 7, O.
Kelite Products Inc., 909 E. 60th St., Los Angeles 1, Cal.
Kondor Products Corp., 18120 Sloane Ave., Lakewood 7 O.
Koppers Co., Tar & Chemical Div., 300 Koppers Bldg., Pittsburgh 19, Pa.
Nox-Rust Corporation, 2431 S. Halsted St., Chicago 8, Ill.
Rheem Research Products Inc., 2523 Pennsylvania Ave., Baltimore 17, Md.
Turco Products, Inc., 6135 S. Central Ave., Los Angeles 54, Cal.

RUST PROOFING PROCESSES AND EQUIPMENT

Alvey-Ferguson Co., The, 85 Disney St., Cincinnati 9, O.
American Chemical Paint Co., Ambler, Pa.
Enterprise Galvanizing Co., 3525 E. Cumberland St., Philadelphia 25, Pa.
Holden, A. F., Co., The, P. O. Box 1898, New Haven 8, Conn.
International Rustproof Corp., 12507 Plover Ave., Lakewood 7, O.
Kelite Products Inc., 909 E. 60th St., Los Angeles 1, Cal.
Mahon, R. C., Co., The, 8650 Mt. Elliott Ave., Detroit 11, Mich.
Nox-Rust Corporation, 2431 S. Halsted St., Chicago 8, Ill.
Oakite Products, Inc., 34E Thames St., New York 6, N. Y.
Parker Rust Proof Co., 2158 E. Milwaukee Ave., Detroit 11, Mich.
Turco Products, Inc., 6135 S. Central Ave., Los Angeles 54, Cal.
Udylite Corp., The, 1651 E. Grand Blvd., Detroit 11, Mich.

SAFE ENDS (Boiler Tube)

Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
National Tube Co., Frick Bldg., Pittsburgh 30, Pa.
Tubular Service Corp., 32 Broadway, New York 4, N. Y.

SAFETY DEVICES (Electric)

Electric Controller & Mfg. Co., The, 2698 E. 79th St., Cleveland 4, O.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Square D Co., 4041 N. Richards St., Milwaukee 12, Wis.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

SAFETY EQUIPMENT

Mahon, R. C., Co., The, 8650 Mt. Elliott Ave., Detroit 11, Mich.
Wahlert Products Corp., 27 Lafayette St., Brooklyn 1, N. Y.

SALT TABLETS

Morton Salt Co., 310 S. Michigan Ave., Chicago 4, Ill.
Wahlert Products Corp., 27 Lafayette St., Brooklyn 1, N. Y.

SAND BLAST EQUIPMENT

American Foundry Equipment Co., 509 S. Byrkit St., Mishawaka, Ind.
Pangborn Corporation, Hagerstown, Md.

SAND CONDITIONING AND PREPARING MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
American Foundry Equipment Co., 509 S. Byrkit St., Mishawaka, Ind.
Jeffrey Mfg. Co., The, 889-99 N. Fourth St., Columbus 16, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.

SAW GUNS (Electric)

Mid-States Equipment Co., Saw-Gun Div., 2425 S. Michigan Ave., Chicago 16, Ill.
Wyzenbeek & Staff Inc., 838 W. Hubbard St., Chicago 22, Ill.

SAWING MACHINES (Contour)

Continental Machines, Inc., 1324 Washington Ave., Minneapolis 4, Minn.

SAWING MACHINES (Hack)

Armstrong-Blum Mfg. Co., 5700 Bloomingdale Ave., Chicago 39, Ill.

SAWING MACHINES (Hot and Cold)

Armstrong-Blum Mfg. Co., 5700 Bloomingdale Ave., Chicago 39, Ill.
Consolidated Machine Tool Corp., 565 Blossom Rd., Rochester 10, N. Y.
Morgan Engineering Co., The, Alliance, O.
United Engineering & Fdry. Co., First National Bank Bldg., Pittsburgh 22, Pa.
Wells Mfg. Co., 1515 Fillmore St., Three Rivers, Mich.

SAWS (Band—Metal Cutting)

Armstrong-Blum Mfg. Co., 5700 Bloomingdale Ave., Chicago 39, Ill.
Delta Mfg. Co., The, 703N E. Vienna Ave., Milwaukee 1, Wis.
Disston, Henry, & Sons, Inc., 526 Tacony, Philadelphia 35, Pa.
DoAll Co., The, 231 N. Laurel Ave., Des Plaines, Ill.
Simonds Saw & Steel Co., 1350 Columbia Rd., Boston 27, Mass.
Wells Mfg. Co., 1515 Fillmore St., Three Rivers, Mich.

SAWS (Hack)

Armstrong-Blum Mfg. Co., 5700 Bloomingdale Ave., Chicago 39, Ill.
Disston, Henry, & Sons, Inc., 526 Tacony, Philadelphia 35, Pa.
Simonds Saw & Steel Co., 1350 Columbia Rd., Boston 27, Mass.

SAWS (Inserted Tooth, Cold)

Disston, Henry, & Sons, Inc., 526 Tacony, Philadelphia 35, Pa.
Simonds Saw & Steel Co., 1350 Columbia Rd., Boston 27, Mass.

SAWS (Metal Cutting)

Armstrong-Blum Mfg. Co., 5700 Bloomingdale Ave., Chicago 39, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence 1, R. I.
Delta Mfg. Co., The, 703N E. Vienna Ave., Milwaukee 1, Wis.
Disston, Henry, & Sons, Inc., 526 Tacony, Philadelphia 35, Pa.
DoAll Co., The, 231 N. Laurel Ave., Des Plaines, Ill.
Genesee Tool Co., Fenton, Mich.
Simonds Saw & Steel Co., 1350 Columbia Rd., Boston 27, Mass.
Walker-Turner Co., Inc., 50123 Berckman St., Plainfield, N. J.
Wells Mfg. Co., 1515 Fillmore St., Three Rivers, Mich.

SAWS (Segmental)

Disston, Henry, & Sons, Inc., 526 Tacony, Philadelphia 35, Pa.
Simonds Saw & Steel Co., 1350 Columbia Rd. Boston 27, Mass.

SCAFFOLDING (Tubular)

Dravo Corp., (Machinery Div.) 300 Penn Ave., Pittsburgh 22, Pa.

SCALES

Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland 10, O.
Fairbanks, Morse & Co., Fairbanks-Morse Bldg., Chicago 5, Ill.
Streeter-Amet Co., 4103 Ravenswood Ave., Chicago 13, Ill.
Toledo Scale Co., P. O. Box 97, W. Toledo Sta., Toledo 12, O.
Yale & Towne Mfg. Co., The, Kron Scale Division, 4530 Tacony St., Philadelphia 24, Pa.

SCALES (Dial & Recording)

Fairbanks, Morse & Co., Fairbanks-Morse Bldg., Chicago 5, Ill.
Streeter-Amet Co., 4103 Ravenswood Ave., Chicago 13, Ill.
Toledo Scale Co., P. O. Box 97, W. Toledo Sta., Toledo 12, O.
Yale & Towne Mfg. Co., The, Kron Scale Division, 4530 Tacony St. Philadelphia 24, Pa.

SCALES (Laboratory)

Fairbanks, Morse & Co., Fairbanks-Morse Bldg., Chicago 5, Ill.
Toledo Scale Co., P. O. Box 97, W. Toledo Sta., Toledo 12, O.
Yale & Towne Mfg. Co., The, Kron Scale Division, 4530 Tacony St. Philadelphia 24, Pa.

SCALES (Monorail)

American MonoRail Co., The, 13102 Athens Ave., Cleveland 7, O.
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Fairbanks, Morse & Co., Fairbanks-Morse Bldg., Chicago 5, Ill.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.
Toledo Scale Co., P. O. Box 97, W. Toledo Sta., Toledo 12, O.
Yale & Towne Mfg. Co., The, Kron Scale Division, 4530 Tacony St. Philadelphia 24, Pa.

SCALES (Steel Mill)

Fairbanks, Morse & Co., Fairbanks-Morse Bldg., Chicago 5, Ill.
Toledo Scale Co., P. O. Box 97, W. Toledo Sta., Toledo 12, O.
Yale & Towne Mfg. Co., The, Kron Scale Division, 4530 Tacony St. Philadelphia 24, Pa.

SCREENS AND SIEVES

Ajax Flexible Coupling Co., 4 English St., Westfield, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Chicago Perforating Co., 2443 W. 24th Pl., Chicago 8, Ill.
Diamond Mfg. Co., Wyoming, Pa.
Erdle Perforating Co., 171 York St., Rochester 11, N. Y.
Harrington & King Perforating Co., 5684 Fillmore St., Chicago 44, Ill.
Hendrick Mfg. Co., 37 Dundaff St., Carbondale, Pa.
Koppers Co., Engineering & Construction Div., 300 Koppers Bldg., Pittsburgh 19, Pa.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y.

SCREENS (Vibrating)

Ajax Flexible Coupling Co., 4 English St., Westfield, N. Y.
Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia 40, Pa.

SCREWDRIVERS (Power)

Detroit Power Screwdriver Co., 2813 W. Fort St., Detroit 16, Mich.

SCREW EXTRACTORS

Greenfield Tap & Die Corp., Greenfield, Mass.

SCREW MACHINE PRODUCTS

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
Burgess-Norton Mfg. Co., 778 Peyton St., Geneva, Ill.
Chicago Screw Co., The, 1026 S. Homan Ave., Chicago 24, Ill.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.
Ferry Cap & Set Screw Co., 2151 Scranton Rd., Cleveland 13, O.
Grammes, L. F., & Sons, Inc., Allentown, Pa.
Hindley Mfg. Co., Valley Falls, R. I.
National Acme Co., The, 170 E. 131st St., Cleveland 8, O.
National Screw & Mfg. Co., The, 2440 E. 75th St., Cleveland 4, O.
Titan Metal Mfg. Co., Bellefonte, Pa.
Tourek, J. J., Mfg. Co., 4701-11 W. 16th St., Chicago 50, Ill.
U. S. Automatic Corp., Amherst, O.

SCREW MACHINES (Automatic, Single and Multiple Spindle)

Brown & Sharpe Mfg. Co., Providence 1, R. I.
Cleveland Automatic Machine Co., 2269 Ashland Ave., Cleveland 3, O.
Cone Automatic Machine Co., Inc., Windsor, Vt.
Greenlee Bros. & Co., 1927 Mason Ave., Rockford, Ill.
National Acme Co., The, 170 E. 131st St., Cleveland 8, O.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland 3, O.
Sheffield Corp., The, 721 Springfield St., Dayton 1, O.

SCREW PLATES

Greenfield Tap & Die Corp., Greenfield, Mass.

SCREW STOCK—See STEEL (Screw Stock)

SCREWS (Cap, Set, Safety-Set)

Chicago Screw Company, The, 1026 S. Homan Ave., Chicago 24, Ill.
Cleveland Cap Screw Co., 2935 E. 79th St., Cleveland 4, O.
Danly Machine Specialties, Inc., 2100 S. 52nd Ave., Chicago 50, Ill.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland 2, O.
National Acme Co., The, 170 E. 131st St., Cleveland 8, O.
National Screw & Mfg. Co., The, 2440 E. 75th St., Cleveland 4, O.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh 3, Pa.
Parker-Kalon Corp., 194-200 Varick St., New York 14, N. Y.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.
Triplex Screw Co., 5341 Grant Ave., Cleveland 5, O.
U. S. Automatic Corp., Amherst, O.

SCREWS (Cold Headed)

American Screw Co., Providence 1, R. I.
Chicago Screw Co., The, 1026 S. Homan Ave., Chicago 24, Ill.
Cleveland Cap Screw Co., 2935 E. 79th St., Cleveland 4, O.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.
Ferry Cap & Set Screw Co., 2151 Scranton Rd., Cleveland 13, O.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland 2, O.
National Screw & Mfg. Co., The, 2440 E. 75th St., Cleveland 4, O.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh 3, Pa.
Pawtucket Mfg. Co., 327 Pine St., Pawtucket, R. I.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.

SCREWS (Conveyor)

Lee Spring Co., Inc., 30 Main St., Brooklyn 1, N. Y.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

SCREWS (Hardened Metallic Drive)

American Screw Co., Providence 1, R. I.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland 2, O.
Parker-Kalon Corp., 194-200 Varick St., New York 14, N. Y.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.
U. S. Automatic Corp., Amherst, O.

SCREWS (Hardened Self-Tapping)

American Screw Co., Providence 1, R. I.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland 2, O.
National Screw & Mfg. Co., The, 2440 E. 75th St., Cleveland 4, O.
Parker-Kalon Corp. 194-200 Varick St., New York 14, N. Y.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.

SCREWS (Machine)

American Screw Co., Providence 1, R. I.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland 2, O.
National Screw & Mfg. Co., The, 2440 E. 75th St., Cleveland 4, O.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.
Triplex Screw Co., 5341 Grant Ave., Cleveland 5, O.
U. S. Automatic Corp., Amherst, O.

SCREWS (Machine, Recessed Head)

American Screw Co., Providence 1, R. I.
Bristol Co., Waterbury 91, Conn.
Central Screw Co., Chicago 9, Ill.
Chandler Products Co., Euclid 17, O.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.
International Screw Co., Detroit 4, Mich
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland 2, O.
National Screw & Mfg. Co., 2440 E. 75th St., Cleveland 4, O.
New England Screw Co., Keene, N. H.
Parker-Kalon Corp., 194-200 Varick St., New York 14, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago 50, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Mfg. Co., Waterbury 91, Conn.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.
U. S. Automatic Corp., Amherst, O.

SCREWS (Nonferrous and Stainless)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
American Screw Co., Providence 1, R. I.
Chicago Screw Co., The, 1026 S. Homan Ave., Chicago 24, Ill.
Federal Screw Works, 3405 Martin Ave., Detroit 10, Mich.
Ferry Cap & Set Screw Co., 2151 Scranton Rd., Cleveland 13, O.
Harper, H. M. Co., The, 2646 Fletcher St., Chicago 18, Ill.
National Screw & Mfg. Co., The, 2440 E. 75th St., Cleveland 4, O.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.
Tourek, J. J., Mfg. Co., 4701-11 W. 16th St., Chicago 50, Ill.

SCREWS (Sheet Metal, Recessed Head)

American Screw Co., Providence 1, R. I.
Bristol Co., Waterbury 91, Conn.
Central Screw Co., Chicago 9, Ill.
Chandler Products Co., Euclid 17, O.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland 2, O.
National Screw & Mfg. Co., 2440 E. 75th St., Cleveland 4, O.
Parker-Kalon Corp., 194-200 Varick St., New York 14, N. Y.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago 50, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Shakeproof Lock Washer Co., Chicago, Ill.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.

SCREWS (Socket, Cold Forged)

Chicago Screw Co., The, 1026 S. Homan Ave., Chicago 24, Ill.
Parker-Kalon Corp., 194-200 Varick St., New York 14, N. Y.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.

SCREWS (Thread Cutting)

American Screw Co., Providence 1, R. I.
National Screw & Mfg. Co., The, 2440 E. 75th St., Cleveland 4, O.
Parker-Kalon Corp., 194-200 Varick St., New York 14, N. Y.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.

SCREWS (Thumb)

National Screw & Mfg. Co., The, 2440 E. 75th St., Cleveland 4, O.
Parker-Kalon Corp., 194-200 Varick St., New York 14, N. Y.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6. Ill.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

SCREWS (Valve Tappet)

Ferry Cap & Set Screw Co., 2151 Scranton Rd., Cleveland 13, O.
U. S. Automatic Corp., Amherst, O.

SCREWS (Wood, Recessed Head)

American Screw Co., Providence 1, R. I.
Bristol Co., Waterbury 91, Conn.
Chandler Products Co., Euclid 17, O.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
Lamson & Sessions Co., The, 1971 W. 85th St., Cleveland 2, O.
National Screw & Mfg. Co., 2440 E. 75th St., Cleveland 4, O.
Parker, Charles, Co., The, Meriden, Conn.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago 50, Ill.
Southington Hardware Mfg. Co., Southington, Conn.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.
Whitney Screw Co., Nashua, N. H.

SCRUBBERS (Gas or Air)—See GAS SCRUBBERS

SEALS (Oil and Grease)

Chicago Rawhide Mfg. Co., 1308 Elston Ave., Chicago 22, Ill.
Goodrich, B. F., Co., The, Akron, O.
Syntron Co., 370 Lexington Ave., Homer City, Pa.

SEAMLESS STEEL TUBING—See TUBING (Seamless Steel)

SEPARATORS (Magnetic)

Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee 1, Wis.
Electric Controller & Mfg. Co., The, 2698 E. 79th St., Cleveland 4, O.
Ohio Electric Mfg. Co., The, 5906 Maurice Ave., Cleveland 4, O.

SHACKLES

Bethlehem Steel Co., Bethlehem, Pa.

SHAFT HANGERS—See HANGERS

SHAFTING

American Brass Co., The, Waterbury 88, Conn.
American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss & Laughlin, Inc., Harvey, Ill.
Commercial Forgings Co., The 3700 E. 91st St., Cleveland 5, O.
Craine-Schrage Steel Co., 1025 S. Oakwood Ave., Detroit 25, Mich.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York 13, N. Y.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg. Pittsburgh 30, Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis 7, Ind.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia 42, Pa.
Union Drawn Steel Div., Republic Steel Corp., Massillon, O.
United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.
Wisconsin Steel Co., 180 N. Michigan Ave., Chicago 1, Ill.
Wyckoff Steel Co., P. O. Box 1256, Pittsburgh 30, Pa.

SHAFTING (Flexible)

Walker-Turner Co., Inc., 50123 Berckman St., Plainfield, N. J.

SHAPERS

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia 42, Pa.
Cincinnati Shaper Co., The, Garrard and Elam Sts., Cincinnati 25, O.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland 14, O.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.

SHAPERS (Spindle)

Walker-Turner Co., Inc., 50123 Berckman St., Plainfield, N. J.

SHAPES (Magnesium)

Dow Chemical Co., The, Midland, Mich.

SHAPES (Steel)

Bethlehem Steel Co., Bethlehem, Pa.
Bliss & Laughlin, Inc., Harvey, Ill.
Brandt, Charles T., Inc., 1702 Ridgley St., Baltimore 30, Md
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco 6, Calif.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Levinson Steel Sales Co., The, 33 Pride St., Pittsburgh 19, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis 7, Ind.
Roebling's, John A., Sons Co., Trenton 2, N. J.
Union Drawn Steel Div., Republic Steel Corp., Massillon, O.
Wisconsin Steel Co., 180 N. Michigan Ave., Chicago 1, Ill.
Wyckoff Steel Co., P. O. Box 1256 Pittsburgh 22, Pa.

SHEAR BLADES

American Shear Knife Co., P. O. Box 355, Homestead, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland 14, O.
Disston, Henry, & Sons, Inc., 526 Tacony, Philadelphia 35, Pa.
Heppenstall Co., Dept. TP, 4620 Hatfield St., Pittsburgh 1, Pa.
Lewthwaite, T. H., Machine Co., Inc., 311 E. 47th St., New York 17, N. Y.
Ohio Knife Co., The, B & O. R.R. & Dreman Ave., Cincinnati 23, O.
Simonds Saw & Steel Co., 1350 Columbia Rd., Boston 27, Mass.
Simonds Worden White Co., 714 Negeley Place, Dayton 7, O.

SHEARS

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown 1, O.
Beatty Machine & Mfg. Co., Hammond, Ind.
Buffalo Forge Co., 158 Mortimer St., Buffalo 5, N. Y.
Cincinnati Shaper Co., The, Garrard and Elam Sts., Cincinnati 25, O.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland 14, O.
Consolidated Machine Tool Corp., 565 Blossom Rd., Rochester 10, N. Y.
Continental Foundry & Machine Co., E. Chicago, Ind.
Hyde Park Fdy. & Mach. Co., Hyde Park, Pa.
Lewis Fdry. & Mach. Div. of Blaw-Knox Co., Pittsburgh 30, Pa.
Lewthwaite, T. H., Machine Co., Inc., 311 E. 47th St., New York 17, N. Y.
Mesta Machine Co., P. O. Box 1466, Pittsburgh 30, Pa.
Morgan Engineering Co., The, Alliance, O.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo 11, N. Y.
O'Neil-Irwin Mfg. Co., 304 8th Ave. S., Minneapolis 15, Minn.
Pawtucket Mfg. Co., 327 Pine St., Pawtucket, R. I.
Streine Tool & Mfg. Co., The New Bremen, O.
Thomas Machine Mfg. Co., Etna Branch P. O., Pittsburgh 23, Pa.
United Engineering & Fdry Co., First National Bank Bldg., Pittsburgh 22, Pa.

SHEARS, ROTARY (Slitting, Beveling, Circling, Flanging)

Consolidated Machine Tool Corp., 565 Blossom Rd., Rochester 10, N. Y.
Hydropress, Inc., 570 Lexington Ave., New York 22, N. Y.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo 11, N. Y.
Simonds Saw & Steel Co., 1350 Columbia Rd., Boston 27, Mass.
Wean Engineering Co., Inc., The Warren, O.
Yoder Co., The, 5500 Walworth Ave., Cleveland 2, O.

SHEET BARS

Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Republic Steel Corp., Dept ST. Cleveland 4, O.
Wisconsin Steel Co., 180 N. Michigan Ave., Chicago 1, Ill.

SHEET LIFTERS AND CARRIERS

American MonoRail Co., The, 13102 Athens Ave., Cleveland 7, O.
Cullen-Friestedt Co., 1308 S. Kilbourn Ave., Chicago 23, Ill.
Hyde Park Fdy. & Mach. Co., Hyde Park, Pa.
Merrill Brothers, 56-04 Arnold Ave. Maspeth L. I., N. Y.
J-B Engineering Sales Co., 3101 East St., New Haven 3, Conn.

SHEET METAL PRODUCTS—See STAMPINGS

SHEET METAL WORKERS MACHINES

Cincinnati Shaper Co., The, Garrard and Elam Sts., Cincinnati 25, O.
Hydraulic Press Mfg. Co., The, Mt. Gilead, O.
Lewthwaite, T. H., Machine Co., Inc., 311 E. 47th St., New York 17, N. Y.
Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo 11, N. Y.
Streine Tool & Mfg. Co., The New Bremen, O.

SHEET WRAPPING (Paper)

Sisalkraft Co., The, 205 W. Wacker Drive, Chicago 6, Ill.

SHEET STEEL PILING (New and Used)

American Rolling Mill Co., The, 3361 Curtis St., Middletown, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Foster, L. B., Co., Inc., P. O. Box 1647, Pittsburgh, Pa.
Inland Steel Co., 33 S. Dearborn St., Chicago 3, Ill.

SHEETS (Acid Resisting)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y.
Haynes Stellite Co., 30 E. 42nd St., New York 17, N. Y.
International Nickel Co., Inc., The, 67 Wall St., New York 5, N. Y.
United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.

SHEETS (Aluminum or Magnesium)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
Dow Chemical Co., The, Midland, Mich.
Reliance Steel Corp. Div. Detroit Steel Corp., 1025 S. Oakwood Ave., Detroit 25, Mich.

SHEETS (Black)

Alan Wood Steel Co., Conshohocken, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh - Chicago
Columbia Steel Co., San Francisco 6, Calif.
Continental Steel Corp., Kokomo, Ind.
Follansbee Steel Corp., Third & Liberty Sts., Pittsburgh 30, Pa.
Granite City Steel Co., Granite City, Ill.
Great Lakes Steel Corp., Ecorse, Detroit 18, Mich.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Reeves Steel & Mfg. Co., Dover, O.
Reliance Steel Corp. Div. Detroit Steel Corp., 1025 S. Oakwood Ave., Detroit 25, Mich.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Superior Sheet Steel Div., Continental Steel Corp., Canton, O.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

SHEETS (Brass, Bronze, Phosphor Bronze, Silicon Bronze, Copper, Nickel, Nickel Silver)

American Brass Co., The, Waterbury 88, Conn.
Bridgeport Brass Co., Bridgeport 2, Conn.
Bristol Brass Corp., The, Bristol, Conn.
International Nickel Co., Inc., The, 67 Wall St., New York 5, N. Y.
Revere Copper & Brass Co., Inc., 230 Park Ave., New York 17, N.Y.
Seymour Manufacturing Co., The, 51 Franklin St., Seymour, Conn.
Western Cartridge Co., Brass Mill Div., East Alton, Ill.

SHEETS (Corrugated)

American Rolling Mill Co., The, 3361 Curtis St., Middletown, O.
Apollo Steel Co., 2243-2244 Oliver Bldg., Pittsburgh 22, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco 6, Calif.
Continental Steel Corp., Kokomo, Ind.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg. Pittsburgh 30, Pa.
Levinson Steel Sales Co., The, 33 Pride St., Pittsburgh 19, Pa.
Reeves Steel & Mfg. Co., Dover, O.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham 2, Ala.
United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.
Weirton Steel Co., Weirton, W. Va.

SHEETS (Deep Drawing and Stamping)

Alan Wood Steel Co., Conshohocken, Pa.
Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
American Petrometal Corp., Broadway at 11th St., Long Island City 2, N. Y.
American Rolling Mill Co., The, 3361 Curtis St., Middletown, O.
Apollo Steel Co., 2243-2244 Oliver Bldg., Pittsburgh 22, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Follansbee Steel Corp., Third & Liberty Sts., Pittsburgh 30, Pa.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York 13, N. Y.
General Steel Warehouse Co., Inc., 1830 N. Kostner Ave., Chicago 39, Ill.
Granite City Steel Co., Granite City, Ill.
Great Lakes Steel Corp., Ecorse, Detroit 18, Mich.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Reliance Steel Corp. Div. Detroit Steel Corp., 1025 S. Oakwood Ave., Detroit 25, Mich.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

SHEETS (Electrical)

Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
American Rolling Mill Co., The, 3361 Curtis St., Middletown, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Follansbee Steel Corp., Third & Liberty Sts., Pittsburgh 30, Pa
Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc. Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago 4, Ill.
Jessop Steel Co., 584 Green St., Washington, Pa.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

SHEETS (Electrolytic Zinc Coated)

American Nickeloid Co., 1310 Second St., Peru, Ill.
Weirton Steel Co., Weirton, W. Va.

SHEETS (Enameling)

Follansbee Steel Corp. Third & Liberty Sts., Pittsburgh 30, Pa.
Great Lakes Steel Corp., Ecorse, Detroit 18, Mich.

SHEETS (Galvanized)

American Rolling Mill Co., The, 3361 Curtis St., Middletown, O.
Apollo Steel Co., 2243-2244 Oliver Bldg., Pittsburgh 22, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco 6, Calif.
Continental Steel Corp., Kokomo, Ind.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
Reeves Steel & Mfg. Co., Dover, O.
Reliance Steel Corp. Div. Detroit Steel Corp., 1025 S. Oakwood Ave., Detroit 25, Mich.

SHEETS (Galvanized) (Con.)

Republic Steel Corp., Dept. ST, Cleveland 4, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Superior Sheet Steel Div., Continental Steel Corp., Canton, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham 2, Ala.
United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.
Weirton Steel Co., Weirton, W. Va.
Wheeling Steel Corp., Wheeling, W. Va.

SHEETS (High Finished)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
American Rolling Mill Co., The, 3361 Curtis St., Middletown, O.
Apollo Steel Co., 2243-2244 Oliver Bldg., Pittsburgh 22 Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Follansbee Steel Corp., Third & Liberty Sts., Pittsburgh 30, Pa.
Great Lakes Steel Corp., Ecorse, Detroit 18, Mich.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg. Pittsburgh 30, Pa.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.
Weirton Steel Co., Weirton, W. Va.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

SHEETS (Hot Rolled and Hot Rolled Annealed)

Alan Wood Steel Co., Conshohocken, Pa.
American Rolling Mill Co., The, 3361 Curtis St., Middletown, O.
Apollo Steel Co., 2243-2244 Oliver Bldg., Pittsburgh 22, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco 6, Calif.
Continental Steel Corp., Kokomo, Ind.
Follansbee Steel Corp., Third & Liberty Sts., Pittsburgh 30, Pa.
Disston, Henry, & Sons, Inc. 526 Tacony, Philadelphia 35, Pa.
Granite City Steel Co., Granite City, Ill.
Great Lakes Steel Corp., Ecorse, Detroit 18, Mich.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg. Pittsburgh 30, Pa.
Levinson Steel Sales Co., The, 33 Pride St., Pittsburgh 19, Pa.
Reeves Steel & Mfg. Co., Dover, O.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham 2, Ala.
United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.
Weirton Steel Co., Weirton, W. Va.
Wheeling Steel Corp., Wheeling, W. Va.
Worth Steel Co., Claymont, Del.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

SHEETS (Hot rolled, Pickled & Annealed)

Reliance Steel Corp. Div. Detroit Steel Corp., 1025 S. Oakwood Ave., Detroit 25, Mich.

SHEETS (Lead or Lead Alloy Coated)

Continental Steel Corp., Kokomo, Ind.
National Lead Co., 111 Broadway, New York 6, N. Y.
Superior Sheet Steel Div., Continental Steel Corp., Canton O.
Weirton Steel Co., Weirton, W. Va.

SHEETS (Long Terne)

American Rolling Mill Co., The, 3361 Curtis St., Middletown, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Continental Steel Corp., Kokomo, Ind.
Reliance Steel Corp. Div. Detroit Steel Corp., 1025 S. Oakwood Ave., Detroit 25, Mich.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Superior Sheet Steel Div., Continental Steel Corp., Canton, O.
United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.
Weirton Steel Co., Weirton, W. Va.
Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

SHEETS (Perforated)

Diamond Mfg. Co., Wyoming, Pa.
Harrington & King Perforating Co., 5634 Fillmore St., Chicago 44, Ill.

SHEETS (Porous)

Moraine Products Div., General Motors Corp., Dayton 1, O.

SHEETS (Roofing)—See ROOFING AND SIDING (Corrugated and Plain)

SHEETS (Stainless)

Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
American Rolling Mill Co., The, 3361 Curtis St., Middletown, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Columbia Steel Co., San Francisco 6, Calif.
Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York 13, N. Y.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago 4, Ill.
Jessop Steel Co., 584 Green St., Washington, Pa.
Republic Steel Corp., Massillon, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.

SHEETS (Stainless Clad)

Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
Granite City Steel Co., Granite City, Ill.
Ave., Chicago 4, Ill.
Jessop Steel Co., 584 Green St., Washington, Pa.

SHEETS (Tin)—See TIN or TERNE PLATE

SHEETS (Tin Mill Black)

Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Follansbee Steel Corp., Third & Liberty Sts., Pittsburgh 30, Pa.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Reeves Steel & Mfg. Co., Dover, O.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

SHELLS (Seamless Drawn)

Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.

SHIMS (Laminated

Laminated Shim Co., Inc., 87 Union St., Glenbrook, Conn.

SHOOK (Crate & Box)

Morgan Lumber Sales Co., 8 East Long St., Columbus, O.

SHOT PEENING

American Foundry Equipment Co., 509 S. Byrkit St., Mishawaka, Ind.

SHOVELS (Power)

Northwest Engineering Co., 28 E. Jackson Blvd., Chicago 4, Ill.

SHOVELS, SPADES, SCOOPS (Hand)

Wood Shovel & Tool Co., Piqua, O.

SHRINKING EQUIPMENT (Metal)

Motor Products Corp., Deep Freeze Div., 2309 Davis St., N. Chicago, Ill.

SIEVES—See SCREENS AND SIEVES

SIGNALING & INTERCOMMUNICATION EQUIPMENT

Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.

SIGNS (Metal)

Grammes, L. F., & Sons, Inc., Allentown, Pa.
Webb Corp., The, Webb City, Mo.

SILICO-MANGANESE

Electro Metallurgical Co., 30 E. 42nd St., New York 17, N. Y.
Samuel, Frank & Co., Inc., Harrison Bldg., Philadelphia 2, Pa.

SILICON BRONZE

Ajax Metal Co., Philadelphia 43, Pa.
American Brass Co., The, Waterbury 88, Conn.
Bohn Aluminum & Brass Corp., Lafayette Bldg., Detroit 26, Mich.
Bridgeport Brass Co., Bridgeport 2, Conn.

SILICON METAL AND ALLOYS

Electro Metallurgical Co., 30 E. 42nd St., New York 17, N. Y.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N.Y.

SKELP (Steel)

Alan Wood Steel Co., Conshohocken, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Wisconsin Steel Co., 180 N. Michigan Ave., Chicago 1, Ill.

SKIPS (Materials Handling)

Dempster Brothers, Inc., 294 Shea Rd., Knoxville 17, Tenn.

SLEEVES (Pipe, Pipe Repair)

Dresser Mfg. Co., Bradford, Pa.

SLEEVES (Piston, Pump & Shaft)

Shenango-Penn Mold Co., 444 W. Third St., Dover, O.

SLEEVES AND EXTENSION SOCKETS

Scully-Jones & Co., 1901 S. Rockwell St., Chicago 8, Ill.

SLITTERS

Bethlehem Steel Co., Bethlehem, Pa.
Cowles Tool Co., 2086 W. 110th St. Cleveland 2, O.
Ohio Knife Co., The, B. & O. R.R. & Dremen Ave., Cincinnati 23, O.
Simonds Saw & Steel Co., 1350 Columbia Rd., Boston 27, Mass.
Simonds Worden White Co., Dayton 7, O.
Wean Engineering Co., Inc., The, Warren, O.
Yoder Co., The, 5300 Walworth Ave., Cleveland 2, O.

SMALL TOOLS

Bokum Tool Co., 14775 Wildemere Ave. Detroit 21, Mich.
Brown & Sharpe Mfg. Co., Providence 1, R. I.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland 14, O.
Cleveland Twist Drill Co., The, 1242 E. 49th St., Cleveland 14, O.
Mercury Products Co., 423 Euclid Ave., Cleveland 14, O.
Woodworth, N. A., Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

SOAKING PITS

Amsler-Morton Co., The, Fulton Bldg., Pittsburgh 22, Pa.
Blaw-Knox Div. of Blaw-Knox Co., Blawnox, Pa.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Surface Combustion Div. of General Properties Co., Inc. 2375 Dorr St., Toledo 1, O.
Tate-Jones & Co., Inc., Leetsdale, Pa.

SOLDER

Bohn Aluminum & Brass Corp., Lafayette Bldg., Detroit 26, Mich.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Kester Solder Co., 4222 Wrightwood Ave., Chicago 39, Ill.
National Lead Co., 111 Broadway New York 6, N. Y.

SOLDER (Silver)

Handy & Harman, 82 Fulton St., New York 7, N. Y.
Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.

SOLDERING EQUIPMENT

Federal Telephone & Radio Corp., Div. International Telephone & Telegraph Corp., 32 Central Ave., Newark 1, N. J.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Holden, A. F., Co., The, P.O. Box 1898, New Haven 8, Conn.
Lepel High Frequency Laboratories Inc., 39 W. 60th St., New York 23, N. Y.
Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.
Victor Equipment Co., 844-54 Folsom St., San Francisco 7, Cal.

SOLENOIDS (Electric)

Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee 1, Wis.
General Electric Co., Schenectady 5, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Ward Leonard Electric Co., 65 South St., Mt. Vernon, N. Y.

SOLVENT (Degreasing)

Kelite Products Inc., 909 E. 60th St., Los Angeles 1, Cal.
Kondor Products Corp., 18120 Sloane Ave., Lakewood 7, O.
Oakite Products, Inc., 34E Thames St., New York 6, N. Y.
Pennsylvania Salt Mfg. Co., Dept. S. Pennsalt Cleaner Div., Philadelphia 7, Pa.

SOUND SYSTEMS

Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.

SPECIAL MACHINERY—See MACHINERY (Special)

SPEED REDUCERS

Cleveland Worm & Gear Co., The, 3270 E. 80th St., Cleveland 4, O.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Foote, Brad, Gear Works, Cicero, Ill.
Foote Bros. Gear & Machine Co., 5225 S. Western Blvd., Chicago 9, Ill.
Grant Gear Works, 2nd & B Sts., Boston 27, Mass.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Horsburgh & Scott Co., The, 5112 Hamilton Ave., Cleveland 14, O.
James, D. O., Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Jones, W. A., Fdry. & Mach. Co., 4437 Roosevelt Rd., Chicago 24, Ill.
Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia 40, Pa.

SPEED REDUCERS (Con.)

Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Philadelphia Gear Works, Erie Ave. & G St., Philadelphia 34, Pa.
Silent Hoist & Crane Co., 849 63rd St., Brooklyn 20, N. Y.
Twin Disc Clutch Co., 1379 Racine Ave., Racine, Wis.
Westinghouse Electric & Mfg. Co., 200 McCandless Ave., Pittsburgh 1, Pa.

SPIEGELEISEN

Electro Metallurgical Co., 30 E. 42nd St., New York 17, N. Y.
New Jersey Zinc Co., 160 Front St., New York 7, N. Y.
Samuel, Frank & Co., Inc., Harrison Bldg., Philadelphia 2, Pa.

SPIKES (Screw)

Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh 3, Pa.
Republic Steel Corp., Dept ST, Cleveland 4, O.

SPINDLES (Grinding)

Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit 6, Mich.
Heald Machine Co., The, Worcester 6, Mass.

SPLICE BARS (Rail)

Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.

SPRAY BOOTHS

Mahon, R. C., Co., The, 8650 Mt. Elliott Ave., Detroit 11, Mich.

SPRINGS (*Also Stainless)

*American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
*Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Hubbard, M. D., Spring Co., 410 Central Ave., Pontiac 12, Mich.
Lee Spring Co., Inc., 30 Main St., Brooklyn 1, N. Y.
Muehlhausen Spring Corp., 921 Michigan Ave., Logansport, Ind.
*Raymond Mfg. Co., Div. Associated Spring Corp., 280 S. Centre St., Corry, Pa.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia 42, Pa.
Washburn Wire Co., 118th St. & Harlem River, New York 35, N.Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y.

SPRINGS (Coil & Elliptic)

Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 S. Centre St., Corry, Pa.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y.

SPRINGS (Compression)

Amerian Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Barnes, Wallace, Co., The, Div. Associated Spring Corp. 97 Main St., Bristol, Conn.
Muehlhausen Spring Corp., 921 Michigan Ave., Logansport, Ind.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 S. Centre St., Corry, Pa.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y.

SPRINGS (Flat Coiled)

American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Athenia Steel Co., Clifton, N. J.
Muehlhausen Spring Corp., 921 Michigan Ave., Logansport, Ind.
Washburn Wire Co., 118th & Harlem River, New York 35, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y.

SPRINGS (Oil Tempered—Flat)

American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Athenia Steel Co., Clifton, N. J.
Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Davis Brake Beam Co., Laurel Ave., & P. R. R., Johnstown, Pa.
Muehlhausen Spring Corp., 921 Michigan Ave., Logansport, Ind.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 S. Centre St., Corry, Pa.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y.

SPRINGS (Torsion)

American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Muehlhausen Spring Corp., 921 Michigan Ave., Logansport, Ind.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 S. Centre St., Corry, Pa.

SPRINGS (Valve)

American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Muehlhausen Spring Corp., 921 Michigan Ave., Logansport, Ind.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 S. Centre St., Corry, Pa.

SPRINKLERS (Automatic)

Blaw-Knox Sprinkler Div., Blaw-Knox Co., Blawnox, Pa.
Grinnell Co., Inc., Providence 1, R. I.

SPROCKETS

Industrial Gear Mfg. Co., 4545 W. Van Buren St. Chicago 24, Ill.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Union Chain & Mfg. Co., Sandusky, O.

SPRUE CUTTERS

Buffalo Forge Co., 158 Mortimer St., Buffalo 5, N. Y.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland 14, O.
Consolidated Machine Tool Corp., 565 Blossom Rd., Rochester 10, N. Y.

STABILIZING EQUIPMENT (Temperature)

Motor Products Corp., Deep Freeze Div., 2309 Davis St., N. Chicago, Ill.

STACKS (Steel)—See BRIDGES, ETC.

STAINLESS STEEL—See listings marked "*" under individual product headings.

STAMPINGS

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
American Tube & Stamping Plant, (Stanley Wks.), Bridgeport 7, Conn.
Barnes, Wallace, Co., The, Div. Associated Spring Corp. 97 Main St., Bristol, Conn.
Brandt, Charles T., Inc., 1702 Ridgely St., Baltimore 30, Md.
Burgess-Norton Mfg. Co., 778 Peyton St., Geneva, Ill.
Davis Brake Beam Co., Laurel Ave. & P. R. R., Johnstown, Pa.
Erdle Perforating Co., 171 York St., Rochester 11, N. Y.
Follansbee Steel Corp., Third & Liberty Sts., Pittsburgh 30, Pa.
Grammes, L. F., & Sons, Inc., Allentown, Pa.
Homestead Valve Mfg. Co., P. O. Box 22, Coraopolis, Pa.
Hubbard, M. D., Spring Co., 410 Central Ave., Pontiac 12, Mich.
Master Products Co., 6400 Park Ave., Cleveland 5, O.
Mullins Mfg. Co., Warren, O.
Noblitt-Sparks Industries, Inc., Columbus, Ind.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 S. Centre St., Corry, Pa.
Rheem Research Products, Inc., 2523 Pennsylvania Ave., Baltimore 17, Md.
Scaife Co., Ann St., Oakmont, Pa.
Standard Products Co., The, 505 Boulevard Bldg., Detroit 2, Mich.
Stanley Works, The, New Britain & Bridgeport, Conn.
Toledo Stamping & Mfg. Co., 90 Fearing Blvd., Toledo 7, O.
Veeder-Root, Inc., Hartford 2, Conn.
Wagner, E. R., Mfg. Co., 4615 N. 32nd St., Milwaukee 9, Wis.
Whitehead Stamping Co., 1667 W. Lafayette Blvd., Detroit 16, Mich.
Worcester Pressed Steel Co., 508 Barber Ave., Worcester 6, Mass.
Wrought Washer Mfg. Co., 2103 S. Bay St., Milwaukee 7, Wis.

STAMPS (Steel)

Bethlehem Steel Co., Bethlehem, Pa.
Cunningham, M. E. Co., 172 E. Carson St., Pittsburgh 19, Pa.
Matthews, Jas. H., & Co., 3978 Forbes St., Pittsburgh 13, Pa.

STAPLES (Wire)

American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria 7, Ill.
National Screw & Mfg. Co., The, 2440 E. 75th St., Cleveland 4, O.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg. Birmingham 2, Ala.
Wickwire Brothers, 189 Main St., Cortland, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y.
Worcester Wire Works, Worcester, Mass.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

STARTERS (Electric Motor)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Clark Controller Co., The, 1146 E. 152nd St., Cleveland 10, O.
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee 1, Wis.
Electric Controller & Mfg. Co., The, 2698 East 79th St., Cleveland 4, O.
General Electric Co., Schenectady 5, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Square D. Co., 4041 N. Richards St., Milwaukee 12, Wis.
Ward Leonard Electric Co., 65 South St., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

STEEL (Alloy)

Alan Wood Steel Co., Conshohocken, Pa.
Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
American Petrometal Corp., Broadway at 11th St., Long Island City 2, N. Y.
American Rolling Mill Co., The, 3361 Curtis St., Middletown, O.
American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Anchor Drawn Steel Co., Latrobe, Pa.
Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
Colonial Steel Div., Vanadium-Alloys Steel Co., Grant Bldg., Pittsburgh 19, Pa.
Columbia Steel Co., San Francisco 6, Calif.
Copperweld Steel Co., Warren, O.
Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y.
Disston, Henry, & Sons, Inc. 526 Tacony, Philadelphia 35, Pa.
Follansbee Steel Corp., Third & Liberty Sts., Pittsburgh 30, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Frasse, Peter A., and Co., Inc., 17 Grand St., New York 13, N. Y.
Great Lakes Steel Corp., Ecorse Detroit 18, Mich.
Harrisburg Steel Corp., Harrisburg, Pa.
Heppenstall Co., Dept. TP, 4620 Hatfield St., Pittsburgh 1, Pa.
Jessop Steel Co., 584 Green St. Washington, Pa.
Midvale Co., The, Nicetown, Philadelphia 40, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh 30, Pa.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Simonds Saw & Steel Co., 1350 Columbia Rd., Boston, Mass.
Stanley Works, The, New Britain & Bridgeport, Conn.
Superior Steel Corp., Carnegie, Pa.
Taylor-Wharton Iron & Steel Co., Easton, Pa.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton 6, O.
United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.
Vanadium-Alloys Steel Co., Latrobe, Pa.
Washburn Wire Co., Phillipsdale, R. I.
Wisconsin Steel Co., 180 N. Michigan Ave., Chicago 1, Ill.
Youngstown Sheet & Tube Co., The Youngstown 1, O.

STEEL (Alloy—Abrasive, Corrosion & Heat Resistant)

Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
American Rolling Mill Co., The, 3361 Curtis St., Middletown, O.
American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bissett Steel Co., The, 945 E. 67th St., Cleveland 8, O.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y.
Firth-Sterling Steel Co., McKeesport, Pa.
Follansbee Steel Corp., Third & Liberty Sts., Pittsburgh 30, Pa.
Frasse, Peter A., and Co., Inc., 17 Grand St., New York 13, N. Y.
Granite City Steel Co., Granite City, Ill.
Great Lakes Steel Corp., Ecorse, Detroit 18, Mich.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago 4, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
International Nickel Co., Inc., The 67 Wall St., New York 5, N. Y.
Jessop, Wm., & Sons, Inc., 627-629 Sixth Ave., New York 11, N. Y.
Jessop Steel Co., 584 Green St., Washington, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Michiana Products Corp., Michigan City, Ind.
Midvale Co., The, Nicetown, Philadelphia 40, Pa.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Roebling's John A., Sons Co., Trenton 2, N. J.
Rustless Iron & Steel Corp., 3400 E. Chase St., Baltimore 13, Md.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Stanley Works, The, New Britain & Bridgeport, Conn.
Superior Steel Corp., Carnegie, Pa.
Taylor-Wharton Iron & Steel Co., Easton, Pa.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton 6, O.

STEEL (Alloy—Cold Finished)

American Rolling Mill Co., The, 3361 Curtis St., Middletown, O.
American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Athenia Steel Co., Clifton, N. J.
Benedict-Miller Inc., 216 Clifford St., Newark 5, N. J.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss & Laughlin, Inc., Harvey, Ill.
Copperweld Steel Co., Warren, O.
Craine-Schrage Steel Co., 1025 W. Oakwood Ave., Detroit 25, Mich.

STEEL (Alloy—Cold Finished) (Con.)

Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y.
Firth-Sterling Steel Co., McKeesport, Pa.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York 13, N. Y.
Moltrup Steel Products Co., Beaver Falls, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis 7, Ind.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton 6, O.
Union Drawn Steel Div., of Republic Steel Corp., Massillon, O.
United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.
Wisconsin Steel Co., 180 N. Michigan Ave., Chicago 1, Ill.
Wyckoff Steel Co., P. O. Box 1256, Pittsburgh 30, Pa.

STEEL (Clad—Corrosion Resisting) (*Also Stainless)

*Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
*Copperweld Steel Co., Warren, O.
Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y.
*Follansbee Steel Corp., Third & Liberty Sts., Pittsburgh 30, Pa.
*Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago 4, Ill.
Jessop Steel Co., 584 Green St., Washington, Pa.
National Forge & Ordnance Co., Irvine, Warren Co., Pa.
Superior Steel Corp., Carnegie, Pa.

STEEL (Cold Finished)

American Petrometal Corp., Broadway at 11th St., Long Island City 2, N. Y.
American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss & Laughlin, Inc., Harvey, Ill.
Craine-Schrage Steel Co., 1025 W. Oakwood Ave., Detroit 25, Mich.
Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y.
Drake Steel Supply Co., 10660 S. Alameda St., Los Angeles 2, Cal.
Firth-Sterling Steel Co., McKeesport, Pa.
Frasse, Peter A., & Co., Inc. 17 Grand St., New York 13, N. Y.
General Steel Warehouse Co., Inc. 1830 N. Kostner Ave., Chicago 39, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis 7, Ind.
Purdy, A. R., Co., 790 Greenwich St., New York 14, N. Y.
Roebling's, John A., Sons Co., Trenton, N. J.
Ryerson, Jos. T., & Son., Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton 6, O.
Union Drawn Steel Div. of Republic Steel Corp., Massillon, O.
United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.
Wisconsin Steel Co., 180 N. Michigan Ave., Chicago 1, Ill.
Wyckoff Steel Co., P. O. Box 1256, Pittsburgh 22, Pa.

STEEL (Die)

Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
Anchor Drawn Steel Co., Latrobe, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
Colonial Steel Div., Vanadium-Alloys Steel Co., Grant Bldg., Pittsburgh 19, Pa.
Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y.
Darwin & Milner, Inc., 1260 W. 4th St., Cleveland 13, O.
Disston, Henry, & Sons, Inc., 526 Tacony, Philadelphia 35, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Follansbee Steel Corp., Third & Liberty Sts., Pittsburgh 30, Pa.
Jessop, Wm., & Sons, Inc., 627-629 Sixth Ave., New York 11, N. Y.
Jessop Steel Co., 584 Green St., Washington, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Midvale Co., The, Nicetown, Philadelphia 40, Pa.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton 6, O.
Vanadium-Alloys Steel Co., Latrobe, Pa.

STEEL (High Speed or Carbon Tool)

Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
Anchor Drawn Steel Co., Latrobe, Pa.
Benedict-Miller, Inc., 216 Clifford St., Newark 5, N. J.
Bethlehem Steel Co., Bethlehem, Pa.
Bissett Steel Co., The, 947 E. 67th St., Cleveland 8, O.
Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
Colonial Steel Div., Vanadium-Alloys Steel Co., Grant Bldg., Pittsburgh 19, Pa.
Copperweld Steel Co., Warren, O.
Craine-Schrage Steel Co., 1025 W. Oakwood Ave., Detroit 25, Mich.
Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y.
Darwin & Milner, Inc., 1260 W. 4th St., Cleveland 13, O.
Disston, Henry & Sons, Inc., 526 Tacony, Philadelphia 35, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Follansbee Steel Corp., Third & Liberty Sts., Pittsburgh 30, Pa.
Holliday, W. J., & Co., Hammond, Ind.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago 4, Ill.
Jessop, Wm., & Sons Co., 627-629 Sixth Ave., New York 11, N. Y.
Jessop Steel Co., 584 Green St., Washington, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Midvale Co., The, Nicetown, Philadelphia 40, Pa.
National Broach & Mach. Co., 5600 St. Jean, Detroit 13, Mich.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Sandvik Steel, Inc., 111 Eighth Ave., New York 11, N. Y.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham 2, Ala.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton 6, O.
Vanadium-Alloys Steel Co., Latrobe, Pa.

STEEL (High Tensile, Low Alloy)

Alan Wood Steel Co., Conshohocken, Pa.
American Rolling Mill Co., The, 3361 Curtis St., Middletown, O.
American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Cold Metal Products Co., The, 2131 Wilson Ave., Youngstown 1, O.
Follansbee Steel Corp., Third & Liberty Sts., Pittsburgh 30, Pa.
Great Lakes Steel Corp., Ecorse, Detroit 18, Mich.
Holliday, W. J., & Co., Hammond, Ind.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh 30, Pa.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton 6, O.
United States Steel Supply Co., P. O. Box MM, Chicago 90, Ill.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

STEEL (Nitrided)

Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
Bethlehem Steel Co., Bethlehem, Pa.

STEEL (Screw Stock)

American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss & Laughlin, Inc., Harvey, Ill.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York 13, N. Y.
Craine-Schrage Steel Co., 1025 W. Oakwood Ave., Detroit 25, Mich.
General Steel Warehouse Co., Inc., 1830 N. Kostner Ave., Chicago 39, Ill.
Holliday, W. J., & Co., Hammond, Ind.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.
Monarch Steel Co., 545 W. McCarty St., Indianapolis 7, Ind.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Union Drawn Steel Div. of Republic Steel Corp., Massillon, O.
United States Steel Supply Co., P. O. Box MM, Chicago 90, Ill.
Wisconsin Steel Co., 180 N. Michigan Ave., Chicago 1, Ill.
Wyckoff Steel Co., P. O. Box 1256, Pittsburgh 30, Pa.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

STEEL (Specialties)

Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y.
Simonds Saw & Steel Co., 1350 Columbia Rd., Boston 27, Mass.

STEEL (Spring)

American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Athenia Steel Co., Clifton, N. J.
Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Cold Metal Products Co., The, 2131 Wilson Ave., Youngstown 1, O.
Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y.
General Steel Warehouse Co., Inc., 1830 N. Kostner Ave., Chicago 39, Ill.
Great Lakes Steel Corp., Ecorse Detroit 18, Mich.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Purdy, A. R., Co., 790 Greenwich St., New York 14, N. Y.
Roebling's, John A., Sons Co., Trenton 2, N. J.
Sandvik Steel Inc., 111 Eighth Ave., New York 11, N. Y.
Thomas Steel Co., The, Warren, O.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton 6, O.
United States Steel Supply Co., P. O. Box MM, Chicago 90, Ill.
Washburn Wire Co., 118th St. & Harlem River, New York 35, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

STEEL (Stainless)—See listings marked "*" under individual product headings.

STEEL (Strip)

Drake Steel Supply Co., 10660 S. Alameda St., Los Angeles 2, Cal.

STEEL (Strip—Brass, Bronze, Copper and Nickel Coated)

American Nickeloid Co., 1310 Second St., Peru, Ill.
American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Stanley Works, The, New Britain & Bridgeport, Conn.
Thomas Steel Co., The, Warren, O.

STEEL (Strip—Hot or Cold Rolled) (*Also Stainless)

Alan Wood Steel Co., Conshohocken, Pa.
*Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
*American Rolling Mill Co., The, 3361 Curtis St., Middletown, O.
American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
American Tube & Stamping Plant, (Stanley Wks.) Bridgeport 7, Conn.
Athenia Steel Co., Clifton, N. J.
Benedict-Miller Inc., 216 Clifford St., Newark 5, N. J.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
*Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
*Cold Metal Products Co., The, 2131 Wilson Ave., Youngstown 1, O.
Columbia Steel Co., San Francisco 6, Calif.
Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y.
Detroit Steel Corp., 1025 S. Oakwood Ave., Detroit 25, Mich.
Enterprise Galvanizing Co., 3525 E. Cumberland St., Philadelphia 25, Pa.
Follansbee Steel Corp., Third & Liberty Sts., Pittsburgh 30, Pa.
*Frasse, Peter A., & Co., Inc., 17 Grand St., New York 13, N. Y.
General Steel Warehouse Co., Inc., 1830 N. Kostner Ave., Chicago 39, Ill.
Great Lakes Steel Corp., Ecorse, Detroit 18, Mich.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago 4, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
Jessop, Wm., & Sons, Inc., 627-629 Sixth Ave., New York 11, N. Y.
Jessop Steel Co., 584 Green St., Washington, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Levinson Steel Sales Co., The, 33 Pride St., Pittsburgh 19, Pa.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Roebling's, John A., Sons Co., Trenton 2, N. J.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Seneca Wire & Mfg. Co., The, Fostoria, O.
*Stanley Works, The, New Britain
*Superior Steel Corp., Carnegie, Pa. & Bridgeport, Conn.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham 2, Ala.
Thomas Steel Co., The, Warren, O.
*United States Steel Supply Co., P. O. Box MM, Chicago 90, Ill.
Washburn Wire Co., 118th St. & Harlem River, New York 35, N. Y.
Weirton Steel Co., Weirton, W. Va.
Wisconsin Steel Co., 180 N. Michigan Ave., Chicago 1, Ill.
Worcester Pressed Steel Co., 508 Barber Ave., Worcester 6, Mass.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

STEEL (Strip—Lacquer Coated)

American Nickeloid Co., 1310 Second St., Peru, Ill.
Thomas Steel Co., The, Warren, O.

STEEL (Strip—Solder Coated)

Thomas Steel Co., The, Warren, O.

STEEL (Strip—Tin Coated)

American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Roebling's, John A., Sons Co., Trenton 2, N. J.
Thomas Steel Co., The, Warren, O.
Washburn Wire Co., 118th St. & Harlem River, New York 35, N. Y.

STEEL (Strip—Zinc Coated)

American Nickeloid Co., 1310 Second St., Peru, Ill.
American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Roebling's, John A., Sons Co., Trenton 2, N. J.
Thomas Steel Co., The, Warren, O.
Washburn Wire Co., 118th St. & Harlem River, New York 35, N. Y.

STEEL (Structural) (*Also Stainless)

American Bridge Co., Frick Bldg., Pittsburgh 19, Pa.
American Petrometal Corp., Broadway at 11th St., Long Island City 2, N. Y.
Belmont Iron Works, 22nd St. and Washington Ave., Philadelphia 46, Pa.
Benedict-Miller Inc., 216 Clifford St., Newark 5, N. J.
Bethlehem Steel Co., Bethlehem, Pa.
*Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
*Columbia Steel Co., San Francisco 6, Calif.
Drake Steel Suppiy Co., 10660 S. Alameda St., Los Angeles 2, Cal.
*Enterprise Galvanizing Co., 3525 E. Cumberland St., Philadelphia 25, Pa.
Ingalls Iron Works Co., The, Birmingham 2, Ala.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Levinson Steel Sales Co., The, 33 Pride St., Pittsburgh 19, Pa.
Mississippi Valley Structural Steel Co., St. Louis, Mo.
*Republic Steel Corp., Dept. ST, Cleveland 4, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham 2, Ala.
*United States Steel Supply Co., P. O. Box MM, Chicago 90, Ill.
Weirton Steel Co., Weirton, W. Va.
Wisconsin Steel Co., 180 N. Michigan Ave., Chicago 1, Ill.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

STEEL BUILDINGS—See BRIDGES, BUILDINGS, ETC.

STEEL DOORS & SHUTTERS—See DOORS & SHUTTERS

STEEL FABRICATORS—See BRIDGES, BUILDINGS, ETC.

STEEL FLOATING AND TERMINAL EQUIPMENT

Dravo Corp. (Engineering Works Div.), Neville Island, Pittsburgh 25, Pa.

STEEL PLATE CONSTRUCTION

American Bridge Co., Frick Bldg., Pittsburgh 19, Pa.
Bartlett-Hayward Div., Koppers Co., Baltimore 3, Md.
Belmont Iron Works, 22nd St. and Washington Ave., Philadelphia 46, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Blaw-Knox Div. of Blaw-Knox Co., Blawnox, Pa.
Brandt, Charles T., Inc., 1702 Ridgely St., Baltimore 30, Md.
Federal Shipbuilding & Dry Dock Co., Kearney, N. J.
General American Transportation Corp., 135 S. La Salle St., Chicago 90, Ill.
Graver Tank & Mfg. Co., Inc., 4811-29 Tod Ave., E. Chicago, Ind.
Hendrick Mfg. Co., 37 Dundaff St., Carbondale, Pa.
Ingalls Iron Works Co., The, Birmingham 2, Ala.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Levinson Steel Sales Co., The, 33 Pride St., Pittsburgh 19, Pa.
Struthers Wells Corp., Titusville, Pa.

STELLITE

Haynes Stellite Co., Harrison and Lindsay Sts., Kokomo, Ind.

STENCILS (Spray and Sand Blast)

Matthews, Jas. H., & Co., 3978 Forbes St., Pittsburgh 13, Pa.

STEPS (Safety)

Hendrick Mfg. Co., 37 Dundaff St., Carbondale, Pa.

STOCK LINE RECORDERS

Otis Elevator Co., 260 11th Ave., New York 1, N. Y.

STOKERS

Babcock & Wilcox Co., The, 85 Liberty St., New York 6, N. Y.
Westinghouse Electric & Mfg. Co., Steam Div., Lester, Pa.

STONES (Honing, Polishing, Sharpening)

Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., The, Niagara Falls, N. Y.
Mid-West Abrasive Co., 1960 E. Milwaukee Ave., Detroit 11, Mich.
Norton Company, Worcester, 6, Mass.

STOPPERS (Cinder Notch)

Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh 22, Pa.

STOPPERS (Rubber)

Rhoades, R. W., Metaline Co., Inc., 50-17 Fifth St., Long Island City 1, N. Y.

STORAGE BATTERIES—See BATTERIES (Storage)

STORAGE EQUIPMENT

Graver Tank & Mfg. Co., Inc., 4811-29 Tod Ave., E. Chicago, Ind.

STRAIGHTENING MACHINES—See BENDING & STRAIGHTENING MACHINES

STUDS (Locked In)

Bardwell & McAlister, Inc., P. O. Box 1310, Hollywood 28, Cal.

SWAGING MACHINES

Torrington Co., The, Torrington, Conn.

SWITCHES (Electric)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee 1, Wis.
Electric Controller & Mfg. Co., The, 2698 E. 79th St., Cleveland 4, O.
General Electric Co., Schenectady 5, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.
Square D Co., 6060 Rivard St., Detroit 11, Mich.
Ward Leonard Electric Co., 65 South St., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

TABLES (Elevating)

Lyon-Raymond Corp., 364 Madison St., Greene, N. Y.

TACHOMETERS

Brown Instrument Co., The, Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia 44, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.
Sticht, Herman H., Co., 27 Park Place, New York 7, N. Y.
Veeder-Root, Inc., Hartford 2, Conn.
Westinghouse Electric & Mfg. Co., Orange Ave., Newark 1, N. J.

TANKS (Gas Auxiliary)

Webb Corp., The, Webb City, Mo.

TANKS (Pickling)

Goodrich, B. F., Co., The, Akron, O.
National Carbon Co., Inc., 30 E. 42nd St., New York 17, N. Y.
National Lead Co., 111 Broadway, New York 6, N. Y.
Tate-Jones & Co., Inc., Leetsdale, Pa.
Youngstown Welding & Eng. Co., 3711 Oakwood Ave., Youngstown 9, O.

TANKS (Plating)

Brandt, Charles T., Inc., 1702 Ridgely St., Baltimore 30, Md.
Goodrich, B. F., Co., The, Akron, O
Siefen, J. J., Co., 5657 Lauderdale Ave., Detroit 9, Mich.
Tate-Jones & Co., Inc., Leetsdale, Pa.
United States Rubber Co., Mechanical Goods Div., 1230 Sixth Ave., New York 20, N. Y.
Youngstown Welding & Eng. Co., The, 3711 Oakwood Ave., Youngstown 9, O.

TANKS (Storage, Pressure, Riveted, Welded)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
American Bridge Co., Frick Bldg., Pittsburgh 19, Pa.
Bartlett-Hayward Div., Koppers Co., Baltimore 3, Md.
Bethlehem Steel Co., Bethlehem, Pa.
Blaw-Knox Div. of Blaw-Knox Co., Blawnox, Pa.
Brandt, Charles T., Inc., 1702 Ridgely St., Baltimore 30, Md.
Consolidated Steel Corp., Ltd., 5700 S. Eastern Ave., Los Angeles 22, Cal.
General American Transportation Corp., 135 S. La Salle St., Chicago 90, Ill.
Graver Tank & Mfg. Co., Inc., 4811-29 Tod Ave., E. Chicago, Ind.
Ingalls Iron Works Co., The, Birmingham 2, Ala.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Mahon, R. C., Co., The, 8650 Mt. Elliott Ave., Detroit 11, Mich.
National Annealing Box Co., Washington, Pa.
Rheem Research Products, 2523 Pennsylvania Ave., Baltimore 17, Md.
Scaife Co., Ann St., Oakmont, Pa.
Struthers Wells Corp., Titusville, Pa.
Tate-Jones & Co., Inc., Leetsdale, Pa.
Youngstown Welding & Eng. Co., The, 3711 Oakwood Ave., Youngstown 9, O.

TANKS (Wood or Steel, Rubber or Lead Lined)

Brandt, Charles T., Inc., 1702 Ridgely St., Baltimore 30, Md.
Goodrich, B. F., Co., The, Akron, O.
Heil Engineering Co., 12903 Elmwood Ave., Cleveland 11, O.
Mahon, R. C., Co., The, 8650 Mt. Elliott Ave., Detroit 11, Mich.
National Lead Co., 111 Broadway, New York 6, N. Y.
Turco Products, Inc., 6135 S. Central Ave., Los Angeles 54, Cal.

TAPES (Adhesive-Paper, Cloth, Fibre, Acetate, Film Backing)

General Electric Co., Sec. A-443-90 Tungar & Metallic Rectifier Div., Bridgeport 2, Conn.
Minnesota Mining & Mfg. Co., 900 Fauquier St., St. Paul 6, Minn.
Nox-Rust Corporation, 2431 S. Halsted St., Chicago 8, Ill.

TAPPING MACHINES

Snyder Tool & Engineering Co., 3400 E. Lafayette St., Detroit 7, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, O.

TAPS AND DIES

Consolidated Machine Tool Corp., 565 Blossom Rd., Rochester 10, N. Y.
Detroit Tap & Tool Co., 8432 Butler St., Detroit 11, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Machine Co., Waynesboro, Pa.
Murchey Machine & Tool Co., 951 Porter St., Detroit 26, Mich.
National Acme Co., The, 170 E. 131st St., Cleveland 8, O.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland 3, O.
Woodworth, N. A., Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

TELEPHONES & TELEPHONE EQUIPMENT

Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.

TERNE PLATE—See TIN OR TERNE PLATE

TESTING EQUIPMENT (Laboratory)

Buehler Ltd., 165 W. Wacker Dr., Chicago 1, Ill.
Cooley Electric Mfg. Corp., 38 S. Shelby St., Indianapolis 7, Ind.
Electric Eye Equipment Co., 11 W. Fairchild St., Danville, Ill.
Steel City Testing Laboratory, 8843 Livernois Ave., Detroit 4, Mich.

TESTING EQUIPMENT (Portable)

Electric Eye Equipment Co., 11 W. Fairchild St., Danville, Ill.
Steel City Testing Laboratory, 8843 Livernois Ave., Detroit 4, Mich.

TESTING MACHINERY (Materials)

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia 42, Pa.
National Broach & Machine Co., 5600 St. Jean, Detroit 13, Mich.
Riehle Testing Machine Div., American Machine & Metals, Inc., E. Moline, Ill.
Steel City Testing Laboratory, 8843 Livernois Ave., Detroit 4, Mich.

THERMIT WELDING EQUIPMENT AND MATERIALS

Metal & Thermit Corp., 120 Broadway, New York 5, N. Y.

THERMOMETERS

Brown Instrument Co., The, Div. of Minneapolis-Honeywell Regulator Co., 4462 Wayne Ave., Philadelphia 44, Pa.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Leeds & Northrup Co., 4957 Stenton Ave., Philadelphia 44, Pa.

THREAD CUTTING TOOLS

Bokum Tool Co., 14775 Wildemere Ave., Detroit 21, Mich.
Detroit Tap & Tool Co., 8432 Butler St., Detroit 11, Mich.
Landis Machine Co., Waynesboro, Pa.
Oster Mfg. Co., The, 2037 E. 61st St., Cleveland 3, O.
Pines Engineering Co., 600 Prairie St., Aurora, Ill.
Plan-O-Mill Corp., 1511 E. Eight Mile Rd., Hazel Park, Mich.

THREADING MACHINES

Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., 951 Porter St., Detroit 26, Mich
Oster Mfg. Co., The, 2037 E. 61st Place, Cleveland 3, O.
Plan-O-Mill Corp., 1511 E. Eight Mile Rd., Hazel Park, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, O.

THREAD MILLING MACHINES

Murchey Machine & Tool Co., 951 Porter St., Detroit 26, Mich.

TIE PLATES

Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Weirton Steel Co., Weirton, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

TIN OR TERNE PLATE

American Rolling Mill Co., The, 3361 Curtis St., Middletown, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Follansbee Steel Corp., Third & Liberty Sts., Pittsburgh 30, Pa.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Weirton Steel Co., Weirton, W. Va.

TIN OR TERNE PLATE (Con.)

Wheeling Steel Corp., Wheeling, W. Va.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

TIN PLATE MACHINERY

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown 1, O.
Kemp, C. M., Mfg. Co., 405 E. Oliver St., Baltimore 2, Md.
Wean Engineering Co., Inc., The, Warren, O.

TITANIUM

Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.

TONGS (Automatic)

Blaw-Knox Div. of Blaw-Knox Co., Blawnox, Pa.
Heppenstall Co., Dept. TP, 4620 Hatfield St., Pittsburgh 1, Pa.

TONGS (Chain Pipe)

Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

TONGS (Rail Handling)

Cullen-Friestedt Co., 1308 S. Kilbourn Ave., Chicago 28, Ill.

TOOL BITS

Anchor Drawn Steel Co., Latrobe, Pa.
Benedict-Miller, Inc., 216 Clifford St., Newark 5, N. J.
Bethlehem Steel Co., Bethlehem, Pa.
Bokum Tool Co., 14775 Wildemere Ave., Detroit 21, Mich.
Black Drill Co., 1400 E. 222nd St. Cleveland 17, O.
Colonial Steel Div., Vanadium-Alloys Steel Co., Grant Bldg., Pittsburgh 19, Pa.
Craine-Schrage Steel Co., 1025 S. Oakwood Ave., Detroit 25, Mich.
Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y.
Jessop Steel Co., 584 Green St., Washington, Pa.
Vanadium-Alloys Steel Co., Latrobe, Pa.

TOOL BITS (High Speed)

Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
Benedict-Miller, Inc., 216 Clifford St., Newark 5, N. J.
Bethlehem Steel Co., Bethlehem, Pa.
Bokum Tool Co., 14775 Wildemere Ave., Detroit 21, Mich.
Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
Craine-Schrage Steel Co., 1025 S. Oakwood Ave., Detroit 25, Mich.
Disston, Henry, & Sons, Inc., 526 Tacony, Philadelphia 35, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Haynes Stellite Co., Harrison and Lindsay Sts., Kokomo, Ind.
Holden, A. F., Co., The, P. O. Box 1898, New Haven 8, Conn.
Jessop Steel Co., 584 Green St., Washington, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Midvale Co., The, Nicetown, Philadelphia 40, Pa.
Simonds Saw & Steel Co., 1350 Columbia Rd., Boston 27, Mass.

TOOL DESIGNING

Acme Pattern & Tool Co., Inc., 232 Findlay St., Dayton 3, O.

TOOL HOLDERS

Apex Machine & Tool Co., 1025 S. Patterson Blvd., Dayton 1, O.
Bokum Tool Co., 14775 Wildemere Ave., Detroit 21, Mich.
Cooper-Bessemer Corp., The, Mt. Vernon, O.
Gisholt Machine Co., 1217 E. Washington Ave., Madison 3, Wis.
Scully-Jones & Co., 1901 S. Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, South Bend 22, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, O.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOLS (Diamond)

Diamond Tool Co., 933 E. 41st St., Chicago 15, Ill.

TOOLS (Electric)

Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.

TOOLS (Non-Sparking, Safety)

Ampco Metal, Inc., Dept. S-11, Milwaukee 4, Wis.

TOOLS (Pneumatic)

Cleveland Pneumatic Tool Co., The, 3781 E. 77th St., Cleveland 5, O.
Cleveland Punch & Shear Works Co., The, 3917 St. Clair Ave., Cleveland 14, O.
Ingersoll-Rand Co., Phillipsburg, N. J.

TOOLS (Precision, Metal Cutting, etc.)

Acme Pattern & Tool Co., Inc., 232 Findlay St., Dayton 3, O.
Bokum Tool Co., 14775 Wildemere Ave., Detroit 21, Mich.
Brown & Sharpe Mfg. Co., Providence 1, R. I.
Carboloy Co., Inc., 11141 E. 8 Mile Blvd., Detroit 32, Mich.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit 6, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Genesee Tool Co., Fenton, Mich.
Gisholt Machine Co., 1217 E. Washington Ave., Madison 3, Wis.
Illinois Tool Works, 2501 N. Keeler Ave., Chicago 39, Ill.
Kennametal, Inc., 200 Lloyd Ave., Latrobe, Pa.
Lewthwaite, T. H., Machine Co., Inc., 311 E. 47th St., New York 17, N. Y.
Mercury Products Co., 423 Euclid Ave., Cleveland 14, O.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Micromatic Hone Corp., 1800 Schoolcraft Ave., Detroit 4, Mich.
Scully-Jones & Co., 1901 S. Rockwell St., Chicago 8, Ill.
Siewek Tool Co., Div. Domestic Industries Inc., 231 S. LaSalle St., Chicago 4, Ill.
South Bend Lathe Works, South Bend 22, Ind.
Vascoloy-Ramet Corp., N. Chicago, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, O.
Woodworth, N. A., Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

TOOLS (Tipped, Carbide)

Bokum Tool Co., 14775 Wildemere Ave., Detroit 21, Mich.
Carboloy Co., Inc., 11141 E. 8 Mile Blvd., Detroit 32, Mich.
Ex-Cell-O Corp., 1228 Oakman Blvd., Detroit 6, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Genesee Tool Co., Fenton, Mich.
Kennametal, Inc., 200 Lloyd Ave., Latrobe, Pa.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Scully-Jones & Co., 1901 S. Rockwell St., Chicago 8, Ill.
Vascoloy-Ramet Corp., N. Chicago, Ill.

TORCHES & BURNERS (Acetylene, Blow, Oxy-Acetylene)

Air Reduction, 60 E. 42nd St., New York 17, N. Y.
Linde Air Products Co., The, 30 E. 42nd St., New York 17, N. Y.
Victor Equipment Co., 844-54 Folsom St., San Francisco 7, Cal.

TORQUE CONVERTERS (Hydraulic)

Twin Disc Clutch Co., 1379 Racine Ave., Racine, Wis.

TOWBOATS

Commercial Iron Works, P. O. Box 2230, Portland 14, Ore.
Dravo Corp., (Engin'r'g Works Div.) Neville Island, Pittsburgh 25, Pa.
Ingalls Iron Works Co., The, Birmingham 2, Ala.

TOWERS (Transmission)

American Bridge Co., Frick Bldg., Pittsburgh 19, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Blaw-Knox Div. of Blaw-Knox Co., Blawnox, Pa.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.

TOWERS (Tubular Hoisting)

Dravo Corp., (Machinery Div.) 300 Penn Ave., Pittsburgh 22, Pa.

TRACK ACCESSORIES

Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Foster, L. B. Co., Inc., P. O. Box 1647, Pittsburgh, Pa.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh 3, Pa.
Taylor-Wharton Iron & Steel Co., Easton, Pa.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham 2, Ala.
United States Steel Supply Co., P. O. Box MM, Chicago 90, Ill.

TRACK BOLTS—See BOLTS (Track)

TRAILERS

Easton Car & Construction Co., Easton, Pa.
Mercury Manufacturing Company, The, 4140 S. Halsted St., Chicago 9, Ill.
Ohio Galvanizing & Mfg. Co., Penn St., Niles, O.
Thomas Truck & Caster Co., Keokuk, Iowa.

TRAMRAILS

American MonoRail Co., The, 13102 Athens Ave., Cleveland 7, O.
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., 1125 E. 283rd St., Wickliffe, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.

TRANSFORMERS (Electric)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
General Electric Co., Schenectady 5, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Westinghouse Electric & Mfg. Co., Sharon, Pa.

TRANSMISSIONS—VARIABLE SPEED

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia 40, Pa.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

TREADS (Safety)

Alan Wood Steel Co., Conshohocken, Pa.
Blaw-Knox Div. of Blaw-Knox Co., Blawnox, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Dravo Corp., (Machinery Div.), 300 Penn Ave., Pittsburgh 22, Pa.
Inland Steel Co., 38 S. Dearborn St., Chicago 3, Ill.
Minnesota Mining & Mfg. Co., 900 Fauquier St., St. Paul 6, Minn.
Norton Company, Worcester 6, Mass.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Tri-Lok Co., 5515 Butler St., Pittsburgh 1, Pa.

TROLLEYS

American MonoRail Co., The, 13102 Athens Ave., Cleveland 7, O.
Chisholm-Moore Hoist Corp., 118 Fremont Ave., Tonawanda, N. Y.
Ford Chain Block Div., American Chain & Cable Co., Inc., 2nd & Diamond Sts., Philadelphia 22, Pa.
Reading Chain & Block Corp., 2102 Adams St., Reading, Pa.
United States Steel Supply Co., P. O. Box MM, Chicago 90, Ill.
Wright Mfg. Div. of American Chain & Cable Co., Inc., York, Pa.

TRUCK CRANES

Dempster Brothers, Inc., 294 Shea Rd., Knoxville 17, Tenn.
Northwest Engineering Co., 28 E. Jackson Blvd., Chicago 4, Ill.
Silent Hoist & Crane Co., 849 63rd St., Brooklyn 20, N. Y.

TRUCKS (Boom)

Dempster Brothers, Inc., 294 Shea Rd., Knoxville 17, Tenn.

TRUCKS (Dump-Industrial)

Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland 10, O.
Crescent Truck Co., 1100 Willow St., Lebanon, Pa.
Dempster Brothers, Inc., 294 Shea Rd., Knoxville 17, Tenn.
Easton Car & Construction Co., Easton, Pa.
Towmotor Corp., 1223 E. 152nd St., Cleveland 10, O.

TRUCKS (Hydraulic Lift)

Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland 10, O.
Baker-Raulang Co., The, 2167 W. 25th St., Cleveland 13, O.
Dempster Brothers, Inc., 294 Shea Rd., Knoxville 17, Tenn.
Mercury Manufacturing Company, The, 4140 S. Halsted St., Chicago 9, Ill.
Towmotor Corp., 1223 E. 152nd St., Cleveland 10, O.

TRUCKS (Industrial)

Baker-Raulang Co., The, 2167 W. 25th St., Cleveland 13, O.
Crescent Truck Co., 1100 Willow St., Lebanon, Pa.
Dempster Brothers, Inc., 294 Shea Rd., Knoxville 17, Tenn.
Easton Car & Construction Co., Easton, Pa.
Mercury Manufacturing Company, The, 4140 S. Halsted St., Chicago 9, Ill.
Ohio Galvanizing & Mfg. Co., Penn St., Niles, O.
Revolvator Company, 391 86th St., N. Bergen, N. J.
Towmotor Corp., 1223 E. 152nd St., Cleveland 10, O.
Wright-Hibbard Industrial Electric Truck Co., Inc., Phelps, N. Y.

TRUCKS (Lift)

Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland 10, O.
Baker-Raulang Co., The, 2167 W. 25th St., Cleveland 13, O.
Clark Tractor Div., Clark Equipment Co., 127 Springfield Place, Battle Creek, Mich.
Crescent Truck Co., 1100 Willow St., Lebanon, Pa.
Easton Car & Construction Co., Easton, Pa.
Elwell-Parker Electric Co., 4501 St. Clair Ave., Cleveland 14, O.
Lyon-Raymond Corp., 364 Madison St., Greene, N. Y.
Mercury Manufacturing Company, The, 4140 S. Halsted St., Chicago 9, Ill.
Revolvator Company, 391 86th St., N. Bergen, N. J.
Towmotor Corp., 1223 E. 152nd St., Cleveland 10, O.
Wright-Hibbard Industrial Electric Truck Co., Inc., Phelps, N. Y.

TRUCKS AND TRACTORS (Electric Industrial)

Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland 10, O.
Baker-Raulang Co., The, 2167 W. 25th St., Cleveland 13, O.
Crescent Truck Co., 1100 Willow St., Lebanon, Pa.
Easton Car & Construction Co., Easton, Pa.
Elwell-Parker Electric Co., 4501 St. Clair Ave., Cleveland 14, O.
Mercury Manufacturing Company, The, 4140 S. Halsted St., Chicago 9, Ill.
Wright-Hibbard Industrial Electric Truck Co., Inc., Phelps, N. Y.

TRUCKS AND TRACTORS (Gasoline or Diesel—Industrial)

Baker-Raulang Co., The, 2167 W. 25th St., Cleveland 13, O.
Clark Tractor Div., Clark Equipment Co., 127 Springfield Place, Battle Creek, Mich.
Crescent Truck Co., 1100 Willow St., Lebanon, Pa.
Elwell-Parker Electric Co., 4501 St. Clair Ave., Cleveland 14, O.
Mercury Manufacturing Company, The, 4140 S. Halsted St., Chicago 9, Ill.
Silent Hoist & Crane Co., 849 63rd St., Brooklyn 20, N. Y.
Towmotor Corp., 1223 E. 152nd St., Cleveland 10, O.

TUBE FITTINGS

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
Trabon Engineering Corp., 1818 E. 40th St., Cleveland 3, O.
Weatherhead Co., The, 300 East 131st St., Cleveland 8, O.

TUBE MILL EQUIPMENT

Aetna-Standard Engineering Co., The, Home Savings Bank Bldg., Youngstown 1, O.
Mackintosh-Hemphill Co., 9th and Bingham Sts., Pittsburgh 3, Pa.
Medart Co., The, 3500 DeKalb St., St. Louis 18, Mo.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Taylor-Wilson Mfg. Co., 15 Thomson Ave., McKees Rocks, Pa.
Wean Engineering Co., Inc., The, Warren, O.
Yoder Co., The, 5500 Walworth Ave, Cleveland 2, O.

TUBE WELDING MACHINES

Yoder Co., The, 5500 Walworth Ave., Cleveland 2, O.

TUBES (Alloy Steel) (*Also Stainless)

*National Annealing Box Co., Washington, Pa.

TUBES (Boiler)

Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bissett Steel Co., The, 945 E. 67th St., Cleveland 8, O.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Michigan Seamless Tube Co., South Lyon, Mich.
Michigan Steel Tube Products Co., 9450 Buffalo St., Detroit 12, Mich.
National Tube Co., Frick Bldg., Pittsburgh 30, Pa.
Ohio Seamless Tube Co., Shelby, O.
Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Standard Tube Co., The, 14600 Woodward Ave., Detroit 3, Mich.
Steel and Tubes Division, Republic Steel Corp., 226 E. 131st St., Cleveland 8, O.
Talon Inc., Steel Tube Div., Oil City, Pa.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton 6, O.
Tubular Alloy Steel Corp., Gary, Ind.
Tubular Service Corp., 32 Broadway, New York 4, N. Y.
United States Steel Supply Co., P. O. Box MM, Chicago 90, Ill.

TUBES (Brass, Bronze, Copper, Nickel, Nickel Silver)

American Brass Co., The, Waterbury 88, Conn.
Bridgeport Brass Co., Bridgeport 2, Conn.
International Nickel Co., Inc., The, 67 Wall St., New York 5, N. Y.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Shenango-Penn Mold Co., 444 W. Third St., Dover, O.
Youngstown Welding & Eng. Co., The, 3711 Oakwood Ave., Youngstown 9, O.

TUBES (Combustion)

Carborundum Co., The, Niagara Falls, N. Y.

TUBES (High Carbon)

Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Drake Steel Supply Co., 10660 S. Alameda St., Los Angeles 2, Cal.
National Tube Co., Frick Bldg., Pittsburgh 30, Pa.
Ohio Seamless Tube Co., Shelby, O.
Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh 30, Pa.
Standard Tube Co., The, 14600 Woodward Ave., Detroit 3, Mich.
Steel and Tubes Division, Republic Steel Corp., 226 E. 131st St., Cleveland 8, O.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton 6, O.
Tubular Service Corp., 32 Broadway, New York 4, N. Y.

TUBES (Pneumatic Dispatch)

Lamson Corporation, 250 Lamson St., Syracuse 1, N. Y.

TUBING (Alloy Steel) (*Also Stainless)

*Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
*Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Bissett Steel Co., The, 945 E. 67th St., Cleveland 8, O.
*Columbia Steel Co., San Francisco 6, Calif.
*Frasse, Peter A., & Co., Inc., 17 Grand St., New York 13, N. Y.
Michigan Seamless Tube Co., South Lyon, Mich.
Michigan Steel Tube Products Co., 9450 Buffalo St., Detroit 12, Mich.
*National Tube Co., Frick Bldg., Pittsburgh 30, Pa.
Ohio Seamless Tube Co., Shelby, O.
*Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh 30, Pa.
*Steel and Tubes Division, Republic Steel Corp., 226 E. 131st St., Cleveland 8, O.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton 6, O.
*Tubular Alloy Steel Corp., Gary, Ind.
*Tubular Service Corp., 32 Broadway, New York 4, N. Y.
*United States Steel Supply Co., P. O. Box MM, Chicago 90, Ill.
*Youngstown Welding & Eng. Co., The, 3711 Oakwood Ave., Youngstown 9, O.

TUBING (Aluminum or Magnesium)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
Dow Chemical Co., The, Midland, Mich.

TUBING (Brass, Silicon-Bronze, Copper or Monel)

American Brass Co., The, Waterbury 88, Conn.
Bridgeport Brass Co., Bridgeport 2, Conn.
Bundy Tubing Co., 10951 Hern Ave., Detroit 13, Mich.
Calumet and Hecla Consolidated Copper Co., Wolverine Tube Div., 1439 Central Ave., Detroit 9, Mich.
International Nickel Co., Inc., The, 67 Wall St., New York 5, N. Y.
Revere Copper & Brass Inc., 230 Park Ave., New York 17, N. Y.
Shenango-Penn Mold Co., 444 W. Third St., Dover, O.
Youngstown Welding & Eng. Co., The, 3711 Oakwood Ave., Youngstown 9, O.

TUBING (Condenser)

Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York 13, N. Y.
Michigan Seamless Tube Co., South Lyon, Mich.
National Tube Co., Frick Bldg., Pittsburgh 30, Pa.
Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh 30, Pa.
Steel and Tubes Division, Republic Steel Corp., 226 E. 131st St., Cleveland 8, O.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton 6, O.

TUBING (Flexible Metal)

American Brass Co., The, Waterbury 88, Conn.
American Metal Hose Branch of The American Brass Co., Waterbury 88, Conn.
Chicago Metal Hose Corp., 1315 S. Third St., Maywood, Ill.
Pennsylvania Flexible Metallic Tubing Co., 7250 Powers Lane, Philadelphia 42, Pa.
Titeflex, Inc., 531 Frelinghuysen Ave., Newark 5, N. J.

TUBING (Mechanical)

Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Drake Steel Supply Co., 10660 S. Alameda St., Los Angeles 2, Cal.
Frasse, Peter A., & Co., Inc., 17 Grand St., New York 13, N. Y.
Michigan Seamless Tube Co., South Lyon, Mich.
National Tube Co., Frick Bldg., Pittsburgh 30, Pa.
Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh 30, Pa.
Standard Products Co., The, 505 Boulevard Bldg., Detroit 2, Mich.
Steel and Tubes Division, Republic Steel Corp., 226 E. 131st St., Cleveland 8, O.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton 6, O.

TUBING (Rubber)

Boston Woven Hose & Rubber Co., P.O. Box 1071, Boston 3, Mass.
Goodrich, B. F., Co., The, Akron, O.
Standard Products Co. The, 505 Boulevard Bldg., Detroit 2, Mich.
United States Rubber Co., Mechanical Goods Div., 1230 Sixth Ave., New York 20, N. Y.

TUBING (Seamless)

Drake Steel Supply Co., 10660 S. Alameda St., Los Angeles 2, Cal.

TUBING (Seamless, Aluminum)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.

TUBING (Seamless Flexible Metal)

American Metal Hose Branch of The American Brass Co., Waterbury 88, Conn.

TUBING (Seamless Steel)

Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Columbia Steel Co., San Francisco 6, Calif.
Drake Steel Supply Co., 10660 S. Alameda St., Los Angeles 2, Cal.
Frasse, Peter A., and Co., Inc., 17 Grand St., New York 13, N. Y.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Michigan Seamless Tube Co., South Lyon, Mich.
National Tube Co., Frick Bldg., Pittsburgh 30, Pa.
Ohio Seamless Tube Co., Shelby, O.
Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton 6, O.
Tubular Alloy Steel Corp., Gary, Ind.
Tubular Service Corp., 32 Broadway, New York 4, N. Y.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

TUBING (Square, Rectangular and Shapes) (*Also Stainless)

*Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
*Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
*Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
Drake Steel Supply Co., 10660 S. Alameda St., Los Angeles 2, Cal.
Michigan Seamless Tube Co., South Lyon, Mich.
*National Tube Co., Frick Bldg., Pittsburgh 30, Pa.
Ohio Seamless Tube Co., Shelby, O.
Standard Tube Co., The, 14600 Woodward Ave., Detroit 3, Mich.
*Steel and Tubes Division, Republic Steel Corp., 226 E. 131st St., Cleveland 8, O.
Tubular Service Corp., 32 Broadway, New York 4, N. Y.

TUBING (Tool Steel)

Sandvik Steel, Inc., 111 Eighth Ave., New York 11, N. Y.

TUBING (Welded)

Drake Steel Supply Co., 10660 S. Alameda St., Los Angeles 2, Cal.

TUBING (Welded Steel) (*Also Stainless)

*Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
*American Welding & Mfg. Co., The, Warren, O.
Babcock & Wilcox Tube Co., The, Welded Tube Div., Alliance, O.
Bundy Tubing Co., 10951 Hern Ave., Detroit 13, Mich.
*Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
Frasse, Peter A., and Co., Inc., 17 Grand St., New York 13, N. Y.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Michigan Steel Tube Products Co., 9450 Buffalo St., Detroit 12, Mich.
National Tube Co., Frick Bldg., Pittsburgh 30, Pa.
Ohio Seamless Tube Co., Shelby, O.
*Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh 30, Pa.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Revere Copper & Brass Inc., 230 Park Ave., New York 17, N. Y.
Standard Tube Co., The, 14600 Woodward Ave., Detroit 3, Mich.
*Steel and Tubes Division, Republic Steel Corp., 226 E. 131st St., Cleveland 8, O.
Talon Inc., Steel Tube Div., Oil City, Pa.
Tubular Service Corp., 32 Broadway, New York 4, N. Y.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.
*Youngstown Welding & Eng. Co., The, 3711 Oakwood Ave., Youngstown 9, O.

TUBULAR PRODUCTS

Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Bundy Tubing Co., 10951 Hern Ave., Detroit 13, Mich.
Michigan Seamless Tube Co., South Lyon, Mich.
Michigan Steel Tube Products Co., 9450 Buffalo St., Detroit 12, Mich.
National Tube Co., Frick Bldg., Pittsburgh 30, Pa.
Noblitt-Sparks Industries, Inc., Columbus, Ind.
Ohio Seamless Tube Co., Shelby, O.
Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh 30, Pa.
Standard Tube Co., The, 14600 Woodward Ave., Detroit 3, Mich.
Steel and Tubes Division, Republic Steel Corp., 226 E. 131st St., Cleveland 8, O.
Timken Roller Bearing Co., The, Steel & Tube Div., Canton 6, O.
Tubular Alloy Steel Corp., Gary, Ind.
Tubular Service Corp., 32 Broadway, New York 4, N. Y.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.
Wallace Supplies Mfg. Co., 1306 Diversey Parkway, Chicago 14, Ill.

TUNGSTEN CARBIDE

Bissett Steel Co., The, 945 E. 67th St., Cleveland 8, O.
Haynes Stellite Co., Harrison and Lindsay Sts., Kokomo, Ind.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

TUNGSTEN CARBIDE (Tools and Dies)

Carboloy Co., Inc., 11141 E. 8 Mile Blvd., Detroit 32, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Genesee Tool Co., Fenton, Mich.
Kennametal, Inc., 200 Lloyd Ave., Latrobe, Pa.

TUNGSTEN METAL AND ALLOYS

Electro Metallurgical Co., 30 E. 42nd St., New York 17, N. Y.
Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.

TURBINES (Steam)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
General Electric Co., Schenectady 5, N. Y.

TURBINES (Steam) (Con.)

Sturtevant, B. F., Co., Hyde Park, Boston 36, Mass.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

TURBO BLOWERS—See BLOWERS

TURNTABLES

American Bridge Co., Frick Bldg., Pittsburgh 19, Pa.
Atlas Car & Mfg. Co., The, 1100 Ivanhoe Rd., Cleveland 10, O.
Bethlehem Steel Co., Bethlehem, Pa.
Easton Car & Construction Co., Easton, Pa.

TURRET LATHES—See LATHES (Turret)

TURRET LATHE CUTTERS (Carbide Tipped)

Firth-Sterling Steel Co., McKeesport, Pa.
Kennametal, Inc., 200 Lloyd Ave., Latrobe, Pa.

TWIST DRILLS

Cleveland Twist Drill Co., The, 1242 E. 49th St., Cleveland 14, O.
Greenfield Tap & Die Corp., Greenfield, Mass.

TYPE (Steel)

Cunningham, M. E., Co., 172 E. Carson St., Pittsburgh 19, Pa.
Matthews, Jas. H., & Co., 3978 Forbes St., Pittsburgh 13, Pa.

VACUUM CLEANERS

General Electric Co., Sec. A-443-90, Tungar & Metallic Rectifier Div., Bridgeport 2, Conn.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Sturtevant, B. F., Co., Hyde Park, Boston 36, Mass.

VACUUM TUBES (Industrial Power)

Federal Telephone & Radio Corp., Div. International Telephone & Telegraph Corp., 32 Central Ave., Newark 1, N. J.
General Electric Co., Schenectady 5, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.

VALVE CONTROLS

Hays Corp., The, 960 Eighth Ave., Michigan City, Ind.
Philadelphia Gear Works, Erie Ave. & G St., Philadelphia 34, Pa.

VALVE CONTROLS (Motor-Operated Units)

Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee 1, Wis.
Ward Leonard Electric Co., 65 South St., Mt. Vernon, N. Y.

VALVES (Air Blast)

Littell, F. J., Machine Co., 4165 N. Ravenswood Ave., Chicago 13, Ill.

VALVES (Blast Furnace)

Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh 22, Pa.
Blaw-Knox Div. of Blaw-Knox Co., Blawnox, Pa.
R-S Products Corp., 122 Berkley St., Philadelphia 44, Pa.

VALVES (Blow-off)

Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
Homestead Valve Mfg. Co., P. O. Box 22, Coraopolis, Pa.
Merco Nordstrom Valve Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.
United States Steel Supply Co., P. O. Box MM, Chicago 90, Ill.

VALVES (Butterfly)

Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
R-S Products Corp., 122 Berkley St., Philadelphia 44, Pa.

VALVES (Check)

Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
Pesco Products Co., 11610 Euclid Ave., Cleveland 6, O.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Reading, Pa.
Weatherhead Co., The, 300 E. 131st St., Cleveland 8, O.

VALVES (Chemical)

Goodrich, B. F., Co., The, Akron, O.
Merco Nordstrom Valve Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Youngstown Welding & Eng. Co., The, 3711 Oakwood Ave., Youngstown 9, O.

VALVES (Control—Air or Hydraulic)

Anker-Holth Mfg. Co., 332 S. Michigan Ave., Chicago 4, Ill.
Baldwin Southwark Div., The, Baldwin Locomotive Works, Philadelphia 42, Pa.
Cleveland Pneumatic Tool Co., The, 3781 E. 77th St., Cleveland 5, O.
Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
Denison Engineering Co., The, 1163 Dublin Rd., Columbus 16, O.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Galland-Henning Mfg. Co., 2747 S. 31st St., Milwaukee 7, Wis.
Hanna Engineering Works, 1765 Elston Ave., Chicago 22, Ill.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago 24, Ill.
Homestead Valve Mfg. Co., P. O. Box 22, Coraopolis, Pa.
Merco Nordstrom Valve Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Pesco Products Co., 11610 Euclid Ave., Cleveland 6, O.
R-S Products Corp., 122 Berkley St., Philadelphia 44, Pa.
Vickers, Inc., 1480 Oakman Blvd., Detroit 32, Mich.
Weatherhead Co., The, 300 E. 131st St., Cleveland 8, O.

VALVES (Electrically Operated)

Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
Cutler-Hammer, Inc., 1211 St. Paul Ave., Milwaukee 1, Wis.
Foxboro Co., The, 118 Neponset Ave., Foxboro, Mass.
Galland-Henning Mfg. Co., 2747 S. 31st St., Milwaukee 7, Wis.
Merco Nordstrom Valve Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.
R-S Products Corp., 122 Berkley St., Philadelphia 44, Pa.

VALVES (Gas and Air Reversing)

Blaw-Knox Div. of Blaw-Knox Co., Blawnox, Pa
Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.

VALVES (Gate)

Bartlett-Hayward Div., Koppers Co., Baltimore 3, Md.
Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Reading, Pa.

VALVES (Globe)

Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
National Carbon Co., Inc., 30 E. 42nd St., New York 17, N. Y.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Reading, Pa.

VALVES (Goggle)

Bailey, Wm. M., Co., 702 Magee Bldg., Pittsburgh 22, Pa.
Bartlett-Hayward Div., Koppers Co., Baltimore 3, Md.

VALVES (Hydraulic)

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia 42, Pa.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
Cross Co., The, 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engineering Co., The, 1163 Dublin Rd., Columbus 16, O.
Galland-Henning Mfg. Co., 2747 S. 31st St., Milwaukee 7, Wis.
Homestead Valve Mfg. Co., P. O. Box 22, Coraopolis, Pa.
Hydraulic Press Mfg. Co., The, Mt. Gilead, O.
Merco Nordstrom Valve Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Pesco Products Co., 11610 Euclid Ave., Cleveland 6, O.
R-S Products Corp., 122 Berkley St., Philadelphia 44, Pa.
Vickers, Inc., 1480 Oakman Blvd., Detroit 32, Mich.
Wood, R. D., Co., 400 Chestnut St., Philadelphia 5, Pa.

VALVES (Lubricated Plug)

Merco Nordstrom Valve Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.

VALVES (Needle)

Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia 42, Pa.
Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Reading, Pa.

VALVES (Plug)

Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
Homestead Valve Mfg. Co., P. O. Box 22, Coraopolis, Pa.

VALVES (Steam, Water)

Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
R-S Products Corp., 122 Berkley St., Philadelphia 44, Pa.
Reading-Pratt & Cady Div. of American Chain & Cable Co., Inc., Reading, Pa.

VANADIUM

Electro Metallurgical Co., 30 E. 42nd St., New York 17, N. Y.

VENTILATING EQUIPMENT (Engine)

Donaldson Co., 666 Pelham St., St. Paul 4, Minn.

VENTILATORS (Roof)

Burt Mfg. Company, The, 400 High St., Akron 11, O.

VIADUCTS (Steel)—See BRIDGES, ETC.

VIBRATION DAMPENERS

Goodrich, B. F., Co., The, Akron O.
Korfund Co., Inc., The, 48-37 32nd Place, Long Island City 1, N. Y.
United States Rubber Co., Mechanical Goods Div., 1230 Sixth Ave., New York 20, N. Y.

VIBRATION ELIMINATORS, PIPING

Power Piping Div., Blaw-Knox Co., Beaver & Western Aves., Pittsburgh 2, Pa.

VIBRATION ISOLATORS (Steel Springs)

Korfund Co., Inc., The, 48-37 32nd Place, Long Island City 1, N. Y.

VIBRATORS (Electric)

Syntron Co., 370 Lexington Ave., Homer City, Pa.

VISES (Hydraulic)

Air Hydraulics Div., Beyer Machine Co., Jackson, Mich.

VISES (Pneumatic)

Air Hydraulics Div., Beyer Machine Co., Jackson, Mich.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago 24, Ill.

WALKWAYS—See FLOORING—(Steel)

WASHERS (Iron and Steel)

Bethlehem Steel Co., Bethlehem, Pa.
Garrett, George K., Co., 1421 Chestnut St., Philadelphia 2, Pa.
Grammes, L. F., & Sons, Inc., Allentown, Pa.
Hubbard, M. D., Spring Co., 410 Central Ave., Pontiac 12, Mich.
Master Products Co., 6400 Park Ave., Cleveland 5, O.
Oliver Iron & Steel Corp., S. 10th & Muriel Sts., Pittsburgh 3, Pa.
Pawtucket Mfg. Co., 327 Pine St., Pawtucket, R. I.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.
U. S. Automatic Corp., Amherst, O.
Whitehead Stamping Co., 1667 W. Lafayette Blvd., Detroit 16, Mich.
Wrought Washer Mfg. Co., 2103 S. Bay St., Milwaukee 7, Wis.

WASHERS (Lead)

Master Products Co., 6400 Park Ave., Cleveland 5, O.
National Lead Co., 111 Broadway, New York 6, N. Y.
Wrought Washer Mfg. Co., 2103 S. Bay St., Milwaukee 7, Wis.

WASHERS (Lock)

Garrett, George K., Co., 1421 Chestnut St., Philadelphia 2, Pa.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.
Wrought Washer Mfg. Co., 2103 S. Bay St., Milwaukee 7, Wis.

WASHERS (Nonferrous and Stainless)

Garrett, George K., Co., 1421 Chestnut St., Philadelphia 2, Pa.
Grammes, L. F., & Sons, Inc., Allentown, Pa.
Harper, H. M., Co., The, 2646 Fletcher St., Chicago 18, Ill.
Master Products Co., 6400 Park Ave., Cleveland 5, O.
Shenango-Penn Mold Co., 444 W. Third St., Dover, O.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.
U. S. Automatic Corp., Amherst, O.
Wrought Washer Mfg. Co., 2103 S. Bay St., Milwaukee 7, Wis.

WASHERS (Spring)

Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Garrett, George K., Co., 1421 Chestnut St., Philadelphia 2, Pa.
Master Products Co., 6400 Park Ave., Cleveland 5, O.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 S. Centre St., Corry, Pa.
Sterling Bolt Co., 217 W. Jackson Blvd., Chicago 6, Ill.
Wrought Washer Mfg. Co., 2103 S. Bay St., Milwaukee 7, Wis.

WATER COOLERS

Blaw-Knox Div. of Blaw-Knox Co., Blawnox, Pa.
General Electric Co., (Air Conditioning & Commercial Refrigeration Div. Sec. 4412), Bloomfield, N. J.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Niagara Blower Co., Dept. S-54, 6 E. 45th St., New York 17, N. Y.
Salem Engineering Co., 714 S. Broadway, Salem, O.
Westinghouse Electric & Mfg. Co., 653 Page Blvd., Springfield 2, Mass.

WATER FILTRATION & SOFTENING EQUIPMENT

Adams, R. P., Co., Inc., 75 Chicago St., Buffalo 4, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Carborundum Co., The, Niagara Falls, N. Y.
Graver Tank & Mfg. Co., Inc., 4811-29 Tod Ave., E. Chicago, Ind.
Syntron Co., 370 Lexington Ave., Homer City, Pa.

WELDED SHEET METAL ASSEMBLIES

Brandt, Charles T., Inc., 1702 Ridgely St., Baltimore 30, Md.
Youngstown Welding & Eng. Co., The, 3711 Oakwood Ave., Youngstown 9, O.

WELDED STEEL CONSTRUCTION

Bartlett-Hayward Div., Koppers Co., Baltimore 3, Md.
Bethlehem Steel Co., Bethlehem, Pa.
Blaw-Knox Div. of Blaw-Knox Co., Blawnox, Pa.
Brandt, Charles T., Inc., 1702 Ridgely St., Baltimore 30, Md.
Danly Machine Specialties, Inc., 2100 S. 52nd Ave., Chicago 50, Ill.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Graver Tank & Mfg. Co., Inc., 4811-29 Tod Ave., E. Chicago, Ind.
Mahon, R. C., Co., The, 8650 Mt. Elliott Ave., Detroit 11, Mich
Tate-Jones & Co., Inc., Leetsdale, Pa
Youngstown Welding & Eng. Co., The, 3711 Oakwood Ave., Youngstown 9, O.

WELDERS (Electric—Arc)

Air Reduction, 60 E. 42nd St., New York 17, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Ergolyte Mfg. Co., 3627 N. Lawrence St., Philadelphia 40, Pa.
General Electric Co., Schenectady 5, N. Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Hobart Bros. Co., The, Box ST 941, Troy, O.
Lee, K. O., Co, Aberdeen, S. Dak
Lincoln Electric Co., The, Cleveland 1, O.
Mid-States Equipment Co., Welding Div., 2425 S. Michigan Ave., Chicago 16, Ill.
Progressive Welder Co., 3050 E. Outer Drive, Detroit 12, Mich.
United States Steel Supply Co., P. O. Box MM, Chicago 90, Ill.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

WELDING

Air Reduction, 60 E. 42nd St., New York 17, N. Y.
American Welding & Mfg. Co., The, Warren, O.
Bartlett-Hayward Div., Koppers Co., Baltimore 3, Md.
Ergolyte Mfg. Co., 3627 N. Lawrence St., Philadelphia 40, Pa.
Eutectic Welding Alloys Co., 40 Worth St., New York 13, N. Y.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Lincoln Electric Co., The, Cleveland 1, O.
Metal & Thermit Corp., 120 Broadway, New York 5, N. Y.
Scaife Co., Ann St., Oakmont, Pa.
Victor Equipment Co., 844-54 Folsom St., San Francisco 7, Cal.

WELDING (Resistance)

American Welding & Mfg. Co., The, Warren, O.
Progressive Welder Co., 3050 E. Outer Drive, Detroit 12, Mich.

WELDING (Stainless)

Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Metal & Thermit Corp., 120 Broadway, New York 5, N. Y.
Youngstown Welding & Eng. Co., The, 3711 Oakwood Ave., Youngstown 9, O.

WELDING (Thermit)

Metal & Thermit Corp., 120 Broadway, New York 5, N. Y.

WELDING AND CUTTING APPARATUS AND SUPPLIES (Electric)

Air Reduction, 60 E. 42nd St., New York 17, N. Y.
Anaconda Wire & Cable Co., 25 Broadway, New York 4, N. Y.
Cutler-Hammer Inc., 1211 St. Paul Ave., Milwaukee 1, Wis.
Electric Controller & Mfg. Co., The, 2698 E. 79th St., Cleveland 4, O.
General Electric Co., Schenectady 5, N. Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Hobart Bros. Co., The, Box ST 941, Troy, O.
Lincoln Electric Co., The, Cleveland 1, O.
McKay Co., The, York, Pa.
Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.
Mid-States Equipment Co., Welding Div., 2425 S. Michigan Ave., Chicago 16, Ill.
Oakite Products, Inc., 34E Thames St., New York 6, N. Y.
Square D Co., 4041 N. Richards St., Milwaukee 12, Wis.
Turco Products, Inc., 6135 S. Central Ave., Los Angeles 54, Cal.
United States Steel Supply Co., P. O. Box MM, Chicago, 90, Ill.
Victor Equipment Co., 844-54 Folsom St., San Francisco 7, Cal.
Wahlert Products Corp., 27 Lafayette St., Brooklyn 1, N. Y.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

WELDING AND CUTTING APPARATUS AND SUPPLIES (Oxy-Acetylene)

Air Reduction, 60 E. 42nd St., New York 17, N. Y.
Linde Air Products Co., The, 30 E. 42nd St., New York 17, N. Y.
Mid-States Equipment Co., Welding Div., 2425 S. Michigan Ave., Chicago 16, Ill.
Oakite Products, Inc., 34E Thames St., New York 6, N. Y.
Turco Products, Inc., 6135 S. Central Ave., Los Angeles 54, Cal.
Victor Equipment Co., 844-54 Folsom St., San Francisco 7, Cal.
Wahlert Products Corp., 27 Lafayette St., Brooklyn 1, N. Y.

WELDING DIES (Flash)

Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.

WELDING FIXTURES

Progressive Welder Co., 3050 E. Outer Drive, Detroit 12, Mich.

WELDING POSITIONERS

Cullen-Friestedt Co., 1308 S. Kilbourn Ave., Chicago 23, Ill.

WELDING RODS (Alloy) (*Also Stainless)

*Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
*Alloy Rods Co., York, Pa.
Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
American Agile Corp., 5800 Hough Ave., Cleveland 3, O.
*American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
*Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
Champion Rivet Co., The, 11200 Harvard Ave., Cleveland 5, O.
Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y.
*Eutectic Welding Alloys Co., 40 Worth St., New York 13, N. Y.
Handy & Harman, 82 Fulton St., New York 7, N. Y.
*Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
International Nickel Co. Inc., The, 67 Wall St., New York 5, N. Y.
Lincoln Electric Co., Cleveland 1, O.
*Linde Air Products Co., The, 30 E. 42nd St., New York 17, N. Y.
*The McKay Co., York, Pa.
Metal & Thermit Corp., 120 Broadway, New York 5, N. Y.
Mid-States Equipment Co., Welding Div., 2425 S. Michigan Ave., Chicago 16, Ill.
*Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Reid-Avery Co., The, Cleveland & Chesapeake Sts., Baltimore 22, Md.
United States Steel Supply Co., P. O. Box MM, Chicago 90, Ill.
Welding Equipment & Supply Co., 223 Leib St., Detroit 7, Mich.
*Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

WELDING RODS (Bronze)

American Brass Co., The, Waterbury 88, Conn.
Ampco Metal, Inc., Dept. S-11, Milwaukee 4, Wis.
Bridgeport Brass Co., Bridgeport 2, Conn.
Eutectic Welding Alloys Co., 40 Worth St., New York 13, N. Y.
Linde Air Products Co., The, 30 E. 42nd St., New York 17, N. Y.
Mid-States Equipment Co., Welding Div., 2425 S. Michigan Ave., Chicago 16, Ill.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Titan Metal Mfg. Co., Bellefonte, Pa.
Welding Equipment & Supply Co., 223 Leib St., Detroit 7, Mich.

WELDING RODS (Hard Surfacing)

Eutectic Welding Alloys Co., 40 Worth St., New York 13, N. Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Haynes Stellite Co., 30 E. 42nd St., New York 17, N. Y.
Lincoln Electric Co., The, Cleveland 1, O.
Metal & Thermit Corp., 120 Broadway, New York 5, N. Y.
Mid-States Equipment Co., Welding Div., 2425 S. Michigan Ave., Chicago 16, Ill.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Taylor-Wharton Iron & Steel Co., Easton, Pa.
United States Steel Supply Co., P. O. Box MM, Chicago 90, Ill.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

WELDING RODS (Magnesium)

Dow Chemical Co., The, Midland, Mich.

WELDING RODS (Tool Steel)

Air Reduction, 60 E. 42nd St., New York 17, N. Y.
Eutectic Welding Alloys Co., 40 Worth St., New York 13, N. Y.
Handy & Harman, 82 Fulton St., New York 7, N. Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Hobart Bros. Co., The, Box ST 941, Troy, O.
Lincoln Electric Co., The, Cleveland 1, O.
McKay Co., The, York, Pa.
Welding Equipment & Supply Co., 223 Leib St., Detroit 7, Mich.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.

WELDING RODS OR WIRE

Air Reduction, 60 E. 42nd St., New York 17, N. Y.
Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
American Agile Corp., 5800 Hough Ave., Cleveland 3, O.
American Brass Co., The, Waterbury 88, Conn.
American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Ampco Metal, Inc., Dept. S-11, Milwaukee 4, Wis.
Benedict-Miller Inc., 216 Clifford St., Newark 5, N. J.
Bridgeport Brass Co., Bridgeport 2, Conn.
Champion Rivet Co., The, 11200 Harvard Ave., Cleveland 5, O.
Eutectic Welding Alloys Co., 40 Worth St., New York 13, N. Y.
General Electric Co., Schenectady 5, N. Y.
Handy & Harman, 82 Fulton St., New York 7, N. Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Hobart Bros. Co., The, Box ST 941, Troy, O.
Keystone Steel & Wire Co., Peoria 7, Ill.
Lincoln Electric Co., The, Cleveland 1, O.
Linde Air Products Co., The, 30 E. 42nd St., New York 17, N. Y.
McKay Co., The, York, Pa.
Metal & Thermit Corp., 120 Broadway, New York 5, N. Y.
Mid-States Equipment Co., Welding Div., 2425 S. Michigan Ave., Chicago 16, Ill.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh 30, Pa.
Reid-Avery Co., The, Cleveland & Chesapeake Sts., Baltimore 22, Md.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 80, Ill.
Seneca Wire & Mfg. Co., The, Fostoria, O.
Welding Equipment & Supply Co., 223 Leib St., Detroit 7, Mich.
Westinghouse Electric & Mfg. Co., Dept. 7-N, E. Pittsburgh, Pa.
Wickwire Brothers, 189 Main St., Cortland, N. Y.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

WELDING TIPS (Spot)

Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.

WELDING WHEELS (Seam)

Mallory, P. R., & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.

WELL WATER SUPPLY SYSTEMS

Layne & Bowler, Inc., Memphis 8, Tenn.

WHEELS (Buffing and Polishing)

Chicago Wheel & Mfg. Co., Dept. ST, 1101 W. Monroe St., Chicago 7, Ill.

WHEELS (Car, Locomotive or Truck)

American Welding & Mfg. Co., The, Warren, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh-Chicago.
Midvale Co., The, Nicetown, Philadelphia 40, Pa.
Standard Steel Works Div. of The Baldwin Locomotive Works, Philadelphia 42, Pa.
Thomas Truck & Caster Co., Keokuk, Ia.

WINCHES (Electric)

Commercial Iron Works, P. O. Box 2230, Portland 14, Oreg.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Shepard Niles Crane & Hoist Corp., 358 Schuyler Ave., Montour Falls, N. Y.
Silent Hoist & Crane Co., 849 63rd St., Brooklyn 20, N. Y.

WINCHES (Gasoline, Diesel)

Silent Hoist & Crane Co., 849 63rd St., Brooklyn 20, N. Y.

WIRE (Alloy Steel) (*Also Stainless)

*Allegheny Ludlum Steel Corp., Dept. S-25, Brackenridge, Pa.
*American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
*Carpenter Steel Co., 139 W. Bern St., Reading, Pa.
*Columbia Steel Co., San Francisco 6, Calif.
*Firth-Sterling Steel Co., McKeesport, Pa.
National-Standard Co., Niles, Mich.
*Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
*Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh 30, Pa.
*Republic Steel Corp., Dept. ST, Cleveland 4, O.
Roebling's, John A., Sons Co., Trenton 2, N. J.
Rustless Iron & Steel Corp., 3400 E. Chase St., Baltimore 13, Md.
Seneca Wire & Mfg. Co., Fostoria, O.

WIRE (Aluminum)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
Titan Metal Mfg. Co., Bellefonte, Pa.

WIRE (Annealed, Bright, Galvanized, Tinned, Coppered)

American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco 6, Calif.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Worcester 1, Mass.
Keystone Steel & Wire Co., Peoria 7, Ill.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh 30, Pa.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Roebling's, John A., Sons Co., Trenton 2, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham 2, Ala.
United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.
Wheeling Steel Corp., Wheeling, W. Va.
Wickwire Brothers, 189 Main St., Cortland, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y.
Worcester Wire Works, Worcester, Mass.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

WIRE (Barb)

American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria 7, Ill.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham 2, Ala.

WIRE (Bead, Braid, & Tapes)

National-Standard Co., Niles, Mich.

WIRE (Brass, Bronze, Phosphor Bronze, Silicon Bronze, Copper or Nickel Silver)

American Brass Co., The, Waterbury 88, Conn.
Bridgeport Brass Co., Bridgeport 2, Conn.
Bristol Brass Corp., The, Bristol, Conn.
Revere Copper & Brass Co., Inc., 230 Park Ave., New York 17, N. Y.
Seymour Manufacturing Co., The, 51 Franklin St., Seymour, Conn.
Titan Metal Mfg. Co., Bellefonte, Pa.

WIRE (Cold Drawn)

American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Johnson Steel & Wire Co., Inc., Worcester 1, Mass.
Keystone Steel & Wire Co., Peoria 7, Ill.
National-Standard Co., Niles, Mich.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Roebling's, John A., Sons Co., Trenton 2, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
United States Steel Supply Co., P. O. Box M M, Chicago 90, Ill.
Washburn Wire Co., 118th St. & Harlem River, New York 35, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y.
Worcester Wire Works, Worcester, Mass.

WIRE (High Carbon)

American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Bethlehem Steel Co., Bethlehem, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
General Steel Warehouse Co., Inc., 1830 N. Kostner Ave., Chicago 39, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Keystone Steel & Wire Co., Peoria 7, Ill.
National-Standard Co., Niles, Mich.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Roebling's, John A., Sons Co., Trenton 2, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Union Wire Rope Corp., 21st and Manchester Ave., Kansas City 3, Mo.
Washburn Wire Co., 118th and Harlem River, New York 35, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y.
Worcester Wire Works, Worcester, Mass.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

WIRE (Magnet)

Anaconda Wire & Cable Co., 25 Broadway, New York 4, N. Y.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.

WIRE (Music)

American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Bethlehem Steel Co., Bethlehem, Pa.
Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y.
Johnson Steel & Wire Co., Inc., Worcester 1, Mass.
Roebling's, John A., Sons Co., Trenton 2, N. J.
Washburn Wire Co., 118th St. and Harlem River, New York 35, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y.
Worcester Wire Works, Worcester, Mass.

WIRE (Round, Flat, Square, Special Shapes)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Athenia Steel Co., Clifton, N. J.
Continental Steel Corp., Kokomo, Ind.
Detroit Steel Corp., 1025 S. Oakwood Ave., Detroit 25, Mich.
General Steel Warehouse Co., Inc., 1830 N. Kostner Ave., Chicago 39, Ill.
Johnson Steel & Wire Co., Inc., Worcester 1, Mass.
Keystone Steel & Wire Co., Peoria 7, Ill.
National-Standard Co., Niles, Mich.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Roebling's, John A., Sons Co., Trenton 2, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Washburn Wire Co., 118th St. and Harlem River, New York 35, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y.
Worcester Wire Works, Worcester, Mass.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

WIRE (Spring)

American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Barnes, Wallace, Co., The, Div. Associated Spring Corp., Bristol, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
General Steel Warehouse Co., Inc., 1830 N. Kostner Ave., Chicago 39, Ill.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Keystone Steel & Wire Co., Peoria 7, Ill.
Muehlhausen Spring Corp., 921 Michigan Ave., Logansport, Ind.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh 30, Pa.
Roebling's, John A., Sons Co., Trenton 2, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Union Wire Rope Corp., 21st and Manchester Ave., Kansas City 3, Mo.
Washburn Wire Co., 118th St. & Harlem River, New York 35, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y.
Worcester Wire Works, Worcester, Mass.
Youngstown Sheet & Tube Co., The, Youngstown 1, O.

WIRE (Stapling)

American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria 7, Ill.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Roebling's, John A., Sons Co., Trenton 2, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y.
Worcester Wire Works, Worcester, Mass.

WIRE (Welding)—See WELDING RODS OR WIRE

WIRE AND CABLE (Electric)

Aluminum Co. of America, 2112 Gulf Bldg., Pittsburgh 19, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Anaconda Wire & Cable Co., 25 Broadway, New York 4, N. Y.
Federal Telephone & Radio Corp., Div. International Telephone & Telegraph Corp., 32 Central Ave., Newark 1, N. J.
General Electric Co., Sec. A-443-90, Tungar & Metallic Rectifier Div., Bridgeport 2, Conn.
Graybar Electric Co., 420 Lexington Ave., New York 17, N. Y.
Progressive Welder Co., 3050 E. Outer Drive, Detroit 12, Mich.
Roebling's, John A., Sons Co., Trenton 2, N. J.

WIRE CLOTH

Buffalo Wire Works Co., Inc., 437 Terrace Rd., Buffalo 2, N. Y.
Cyclone Fence Div., American Steel & Wire Co., Waukegan, Ill.
Roebling's, John A., Sons Co., Trenton 2, N. J.
Rolock, Inc., 1350 Kings Highway, Fairfield, Conn.
Seneca Wire & Mfg. Co., Fostoria, O.
Wickwire Brothers, 189 Main St., Cortland, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y.

WIRE COILING TOOLS (Cemented Carbide)

Firth-Sterling Steel Co., McKeesport, Pa.
Kennametal, Inc., 200 Lloyd Ave., Latrobe, Pa.

WIRE COVERING MACHINES

Fidelity Machine Co., 3908-18 Frankford Ave., Philadelphia 24, Pa.

WIRE FORMS, SHAPES AND SPECIALTIES

American Chain Div. American Chain & Cable Co., Inc., York, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Barnes, Wallace, Co., The, Div. Associated Spring Corp., 97 Main St., Bristol, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Wire Works Co., Inc., 437 Terrace Rd., Buffalo 2, N. Y.
Firth-Sterling Steel Co., McKeesport, Pa.
Grammes, L. F., & Sons, Inc., Allentown, Pa.
Hubbard, M. D., Spring Co., 410 Central Ave., Pontiac 12, Mich.
Keystone Steel & Wire Co., Peoria 7, Ill.
Muehlhausen Spring Corp., 921 Michigan Ave., Logansport, Ind.
Raymond Mfg. Co., Div. Associated Spring Corp., 280 S. Centre St., Corry, Pa.
Roebling's, John A., Sons Co., Trenton 2, N. J.
Wallace Supplies Mfg. Co., 1306 Diversey Parkway, Chicago 14, Ill.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y

WIRE FORMING MACHINERY

Nilson, A. H., Machine Co., The, Bridgeport 5, Conn.
Wean Engineering Co., Inc., The, Warren, O.

WIRE GALVANIZING EQUIPMENT (Electro)

Meaker Co., The, 1635 S. 55th St., Chicago 50, Ill.

WIRE MILL EQUIPMENT

Crucible Steel Co. of America, 405 Lexington Ave., New York 17, N. Y.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Fidelity Machine Co., 3908-18 Frankford Ave., Philadelphia 24, Pa.
Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh 30, Pa.
Lewis Machine Co., 3450 E. 76th St., Cleveland 4, O.
Morgan Construction Co., Worcester 5, Mass.
Shuster, F. B., Mfg. Co., Inc., The, New Haven 9, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

WIRE NAILS—See NAILS

WIRE PRODUCTS (*Also Stainless)

*American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
*Buffalo Wire Works Co., Inc., 437 Terrace Rd., Buffalo 2, N. Y.
Continental Steel Corp., Kokomo, Ind.
Grammes, L. F., & Sons, Inc., Allentown, Pa.
Hubbard, M. D., Spring Co., 410 Central Ave., Pontiac 12, Mich.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Keystone Steel & Wire Co., Peoria 7, Ill.
Leschen, A., & Sons Rope Co., 5909 Kennerly Ave., St. Louis 12, Mo.
Muehlhausen Spring Corp., 921 Michigan Ave., Logansport, Ind.
Page Steel & Wire Div. of American Chain & Cable Co., Inc., Monessen, Pa.
*Pittsburgh Steel Co., 1643 Grant Bldg., Pittsburgh 30, Pa.
Republic Steel Corp., Dept. ST, Cleveland 4, O.
Roebling's, John A., Sons Co., Trenton 2, N. J.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham 2, Ala.
Wickwire Brothers, 189 Main St., Cortland, N. Y.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y.

WIRE ROPE

American Cable Div. of American Chain & Cable Co., Inc., Wilkes-Barre, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco 6, Calif.
Craine-Schrage Steel Co., 1025 S. Oakwood Ave., Detroit 25, Mich.
Hazard Wire Rope Div. of American Chain & Cable Co., Inc., Wilkes-Barre, Pa.
Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh 30, Pa.
Leschen, A., & Sons Rope Co., 5909 Kennerly Ave., St. Louis 12, Mo.
Macwhyte Co., 2912 14th Ave., Kenosha, Wis.
Roebling's, John A., Sons Co., Trenton 2, N. J.
Union Wire Rope Corp., 21st and Manchester Ave., Kansas City 3, Mo.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y.

WIRE ROPE FITTINGS

American Cable Div. of American Chain & Cable Co., Wilkes-Barre, Pa.

WIRE ROPE FITTINGS (Con.)

American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Bethlehem Steel Co., Bethlehem, Pa.
Hazard Wire Rope Div., American Chain & Cable Co., Wilkes-Barre, Pa.
Leschen, A., & Sons Rope Co., 5909 Kennerly Ave., St. Louis 12, Mo.
Macwhyte Co., 2912 14th Ave., Kenosha, Wis.
Roebling's, John A., Sons Co., Trenton 2, N. J.

WIRE ROPE SLINGS

American Cable Div. American Chain & Cable Co., Inc., Wilkes-Barre, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland 13, O.
Bethlehem Steel Co., Bethlehem, Pa.
Hazard Wire Rope Div., American Chain & Cable Co., Inc., Wilkes-Barre, Pa.
Leschen, A., & Sons Rope Co., 5909 Kennerly Ave., St. Louis 12, Mo
Macwhyte Co., 2912 14th Ave., Kenosha, Wis.
Roebling's, John A., Sons Co., Trenton 2, N. J.
Union Wire Rope Corp., 21st and Manchester Ave., Kansas City 3, Mo.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York 18, N. Y.

WIRE SPOOLING MACHINES

Fidelity Machine Co., 3908-18 Frankford Ave., Philadelphia 24, Pa.

WIRE STRAIGHTENING AND CUTTING MACHINERY

Lewis Foundry & Machine Div. of Blaw-Knox Co., Pittsburgh 30, Pa.
Lewis Machine Co., 3450 E. 76th St., Cleveland 4, O.
Shuster, F. B., Mfg. Co., Inc., New Haven 9, Conn.
Shuster, F. B., Mfg. Co., Inc., The, New Haven 9, Conn.

WIRE WINDING MACHINES

Fidelity Machine Co., 3908-18 Frankford Ave., Philadelphia 24, Pa.

WORK REST BLADES (Centerless Grinder)

Scully-Jones & Co., 1901 S. Rockwell St., Chicago 8, Ill.

WRENCHES (Drop Forged)

Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

WRENCHES (Torque)

Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

X-RAY EQUIPMENT (Industrial)

Westinghouse Electric & Mfg. Co., Baltimore 3, Md.

ZINC

American Zinc, Lead & Smelting Co., 943 Paul Brown Bldg., St. Louis 1, Mo.
New Jersey Zinc Co., 160 Front St., New York 7, N. Y.

ZINC ALLOYS

New Jersey Zinc Co., 160 Front St., New York 7, N. Y.

ZINC OXIDE

American Zinc, Lead & Smelting Co., 943 Paul Brown Bldg., St. Louis 1, Mo.
Anaconda Sales Company, 25 Broadway, New York 4, N. Y.
New Jersey Zinc Co., The, 160 Front St., New York 7, N. Y.

ZINC (Rolled Sheets, Strip, Coils)

New Jersey Zinc Co., 160 Front St., New York 7, N. Y.

ZINC SLABS

American Zinc, Lead & Smelting Co., 943 Paul Brown Bldg., St. Louis 1, Mo.
Anaconda Sales Company, 25 Broadway, New York 4, N. Y.
New Jersey Zinc Co., The, 160 Front St., New York 7, N. Y.

ZIRCONIUM METAL AND ALLOYS

Electro Metallurgical Co., 30 E. 42nd St., New York 17, N. Y.